McGraw-Hill Publishing Company, Inc. SEPTEMBER, 1936 Price 35c. per copy

AVIATION

The Oldest American Aeronautical Magazine

AT THE
AIR RACES

This Issue

DESIGN AND PRODUCTION

Designing planes for the National Air Races, page 15

A new control system for all purposes, Flying Equipment.

What is lateral stability? page 29

What is inside the case of the constant speed propeller governor, Flying Equipment

New ground trainer makes record of "flights" Flying Equipment

Catapults for heavily loaded seaplanes, page 19

Production meeting of the S.A.E., News Section

TRANSPORT

TWA and United in re-equipment programs, News Section.

How tomorrow's seaplanes may be launched, page 19

ARMY AND NAVY

Army orders 150 G Cyclones, 3 experimental Curtiss-Wright pursuits, News Section.

Bids opened for Air Corps Basic Trainers, Northrop, North American and Seversky are bidders, News Section.

Coast Guard orders Viking Flying boats, News Section.

PILOTS AND FLYING SERVICES

Charter reliability at any cost, page 22.

What operators think of the approved school regulations, page 49

Keeping the airport visiting public under control, page 28.

Complete details of the Lockheed 12 for feeder line operation, page 33

Published monthly, price 35c a copy. Subscription rates—United States, Canada, Mexico and Central and South American Countries, $3.00 a year. All other countries, $4.00 a year or 24 shillings. Application for entry as second class matter at Albany, N. Y., pending. Printed in U. S. A. Cable address McGrawhill, New York. Member of A.B.C. Copyright 1936 by McGraw-Hill Publishing Company, Inc. 330 West 42d Street, New York, N. Y. The following publications are combined with AVIATION: AERONAUTICAL ENGINEERING, AIRCRAFT JOURNAL, and THE AVIATION NEWS.

AVIATION

Established 1916 McGraw-Hill Publishing Company Inc
THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

★

Contents for September, 1936

Volume 30, Number 9

★

McGRAW-HILL PUBLISHING COMPANY, INC.

Publication Office:
20-22 N. Broadway, Albany, N. Y.

Editorial and Executive Offices:
330 W. 42d St., New York City

James H. McGraw Jr., Chairman — Malcolm Muir, President — James H. McGraw, Honorary Chairman
Louis F. Stoll, Vice-President — D. H. Putnam, Treasurer — D. C. McGraw, Secretary

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta

"EASTERN" FLIES GOODRICH-EQUIPT PLANES MORE THAN 18,860 MILES A DAY

Giant Douglas Transports Using Goodrich Aviation Equipment Give Speed–Safety–Comfort to Eastern Air Lines' Passengers

EVERY 24 hours Eastern Air Lines' planes travel 18,860 miles carrying passengers, mail and express over airways criss-crossing the vast areas of eastern, southern and central states. A huge task that requires not only a smooth running organization in the air and on the ground but requires equipment able to "stand up."

Where tires are concerned Eastern Air Lines believes in playing safe. It equips its planes with Goodrich Low Pressure Silvertowns. It is this low pressure construction that gives smooth landing on rough ground. It means a wider, SAFER contact on both the snow and sand that Eastern planes land on when going north and south in winter. And Silvertowns are tough—they stand up for hundreds of safe landings and take-offs. It's no wonder that "Silvertown landings" are a part of the "safety protection" surrounding every Eastern Air Lines' traveler.

Over 40 Products

Remember, Goodrich Airplane Silvertowns are the world's most universally used airplane tire. But Goodrich "air-mindedness" doesn't stop there. Goodrich also builds De Icers, Abrasion Shoes—*more than 40 products in all*—for the leading pilots, plane makers and airlines. Why not benefit by this unusual aviation experience when planning your new planes or re-equipping present ones? See your nearest Goodrich dealer without delay or write Dept. 619, Aeronautical Division of The B. F. Goodrich Co., Akron, Ohio, for complete information about Goodrich Airplane Silvertowns and the more than 40 Goodrich Aviation Products.

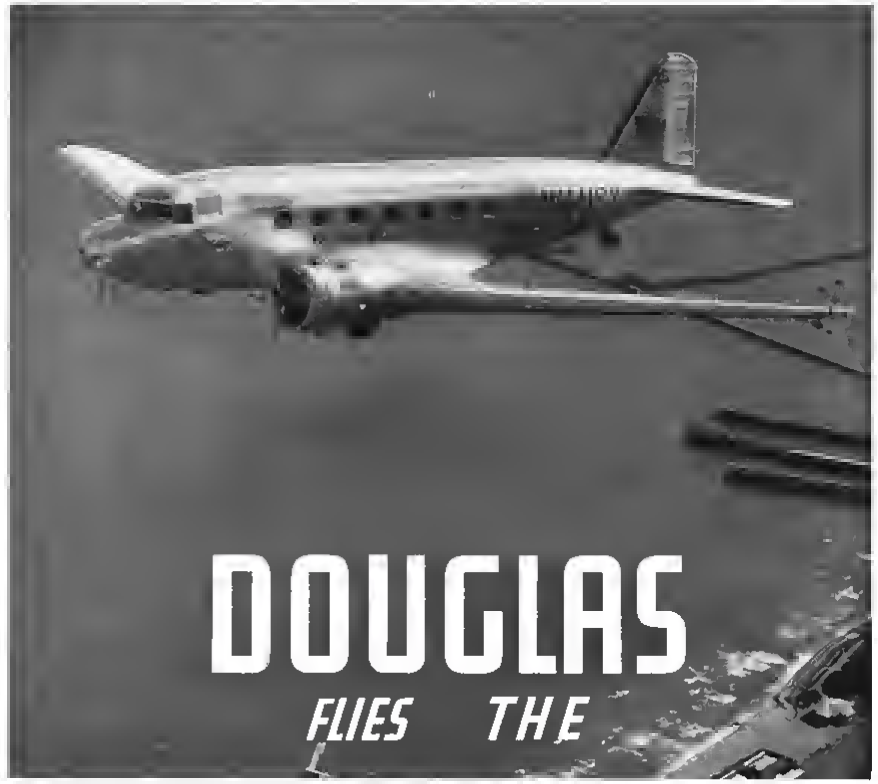
GOODRICH PROTECTED INSIDE AND OUT. Eastern Air Lines' Douglas Transports, in addition to having the extra landing safety of Goodrich Low Pressure Silvertowns, are equipped with Goodrich De Icers, Abrasion Shoes, Gasoline Hose, Radiator Hose, Cromnets, Rubber Cements and Goodrich Rubber Tubing.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes—Inflating Tires—Tail Wheels—Abrasion Shoes—De Icers—Mailing—Rubber Hose—Cromnets—Shock Absorber Cord—A Complete Line of Rubber Aeronautical Accessories



ROYAL MAIL

Around the world time and distance are now measured by Douglas Transports. Even to distant Tasmania the Royal Mail now flies under a new schedule with these familiar airplanes, which Holyman's Airways have inaugurated from Hobart to Melbourne in Australia. + Under the flags of some twenty-five world nations—including five of America's major airlines—Douglas Transports have established a new era in air travel—offering luxury and speed combined with a new standard of flight security. + Douglas Aircraft Company, Inc., Santa Monica, California.

WHEREVER YOU GO . . TRAVEL VIA LUXURIOUS DOUGLAS EQUIPMENT

In **AMERICA** . . . on American Airlines, Inc. . . . Eastern Airlines . . . Pan American Airways . . . T W A., Inc., and Wilmington Catalina Airline, Ltd.
In **THE ORIENT** . . . on Japan Air Transport, China National Aviation Corporation, and K N I L M in the Netherlands Indies
In **SOUTH AMERICA** . . on Pan American Grace Airways
In **EUROPE** . . Deutsche Lufthansa in Germany, K. L. M in the Netherlands, L A P E in Spain, L O T in Poland; C L S in Czechoslovakia; Avio Linee Italiene in Italy, and Swissair in Switzerland.
In **AUSTRALIA** . . Holyman's Airways

STRENGTH

for sustained engine speeds

●

The high speeds and sustained operation demanded of the modern aircraft engine, call for materials of exceptional toughness and strength. Propeller shafts, crankshafts, connecting rods, gears, and many other parts subjected to severe stresses, must be as dependable as modern metallurgy can make them.

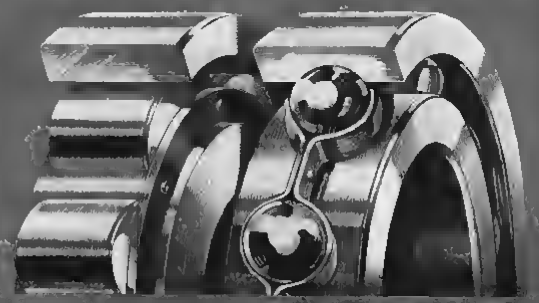
Since its inception, the aircraft industry has specified the Nickel Alloy Steels for vital engine applications. Because of the superior resistance which they offer to high stresses, wear and fatigue, the Nickel Alloy Steels are not only reliable but economical. The long service life which they provide minimizes cost of upkeep.

Consultation on problems involving the use of alloys containing Nickel is invited.

NICKEL ALLOY STEELS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

TWIN PRECISION



"NORMA-HOFFMANN"

BALL & ROLLER BEARINGS

for any

LOAD - SPEED *or* DUTY

ASK FOR CATALOG AND ENGINEERING COUNSEL

NORMA BALL BEARINGS CORP'N - STAMFORD, CONN. U.S.A.

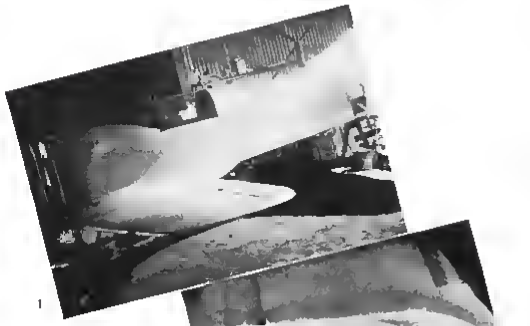
★ ★ ★ AVIATION *for September, 1936*

Preparations for 1936 Air Races *Go on* BEHIND CLOSED DOORS

By
AVIATION'S
Secret Agent
1313X

As this is written, the time is exactly two weeks before the opening gun of the 1936 National Air Races. Reports of super-streamlined flying bullets and mysterious last minute air race entries are rife throughout the land. Previous pre-race hysteria is far surpassed by the flood of rumors and counter-rumors now circulating from behind closed doors of factories, hangars, private garages and other secret hiding places where the high priests of speed are brewing their strange potions

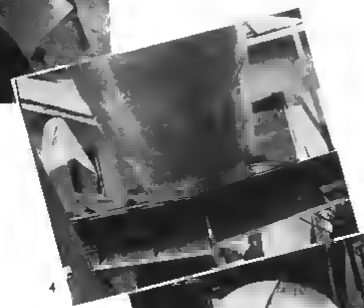
AVIATION'S Special Secret Service Agent No 1313X has just returned from a scouting expedition that would put the annual voyage of Santa Claus to shame. By means of greasing his coat tails, disguising himself as a nonentity, pulling the wool over various sharp eyes, and making generous use of the fourth dimension he has been able to strike a new high in getting the low-down on planes and personalities which are to provide the thrills for record-breaking Air Race crowds As you read the newspapers and listen to the radio announcing who really did win the several events it may be a matter of more than passing amusement to read over this pre-race recapitulation of the situation as it now looks. You can then compare the known results with the advance ballyhoo and say, "I knew that guy was talking through his hat all the time." By that time the bewhiskered (disguise), bewildered and bedeviled author will have his arms draped around the shoulders of the various losers while all will chant in unison "The saddest words of tongue or pen are only these, 'It might have been'" [Ed note—That sounds to us like a slightly garbled quotation but let it pass, we left our copy of Shakespeare home on the kitchen sink.] [Ed note No 2—Take it away, Operative 1313X! You've already wasted too much of our readers' time, not to mention editorial space!]



1

2

3



4

5

have witnessed the greatest show in air racing history. But they will be wrong! The real race is now going on behind those closed doors. The races are being won or lost as this is being written in the shops and hangars where technicians, non-technicians, and would-be technicians strive desperately, in some cases almost hopelessly, to get their speedsters built, tested, and properly groomed for the actual speed tests. No! The crowds may cheer themselves hoarse as the Thompson Trophy thunders into air race history, but the real thrill and the genuine drama were being enacted days and weeks before, as Roscoe Turner and his mechanic drove their construction crew day and night on his new Twin-Wasp racer—as Jacqueline Cochrane Odlum and Wesley Smith supervised installation of a Twin-Wasp in the fast Vance Breese monoplane—as Amelia Earhart and Lockheed engineers fought for permission to carry sufficient fuel in her new Electra to permit a non-stop transcontinental flight—as Art Chester carefully and meticulously checked every nut and cotter key on ship and engine—as pretty little Mrs. Elmendorff held the single drop cord light aloft for Dave and his midnight crew struggling in the dirt and confusion of an isolated little hangar—as debonair Al Menasco (Horatio Alger hero among aircraft engine men) donned coveralls and wallowed cursing in the oily water of his various super-super-charged engines. The real drama and the real significance of the National Air Races have been quietly and in most cases secretly enacted by such men as William O. Buchanan with his Miller powered flying bullet, Harry Crosby and his wind tunnel testing of carefully engineered scale models, Marion McKeen with his complete revamping of "Miss Los Angeles" to get the last available ounce of speed and reliability, Eddie Allenbaugh with his 375 cu.in. Argus-powered hope, George Haldeman and his desperate effort to get an engine in his 375 cu.in. prospect in time for the races, and others whom even Operative 1313X has been unable to ferret out.

As the 1936 National Air Races go to the post it seems obvious that air racing has finally reached a substantial footing comparable to the annual Indianapolis Speedway Classic. It also seems possible that future speed jobs will be largely concentrated in the smaller power classes, and particularly around in-line engines. With a little help from Detroyat and his two Caudron planes, three Renault engines, and crew of mechanics, indications are that the in-line jobs will this year perform in spectacular fashion. It is probable that 1937 will see major sponsorship for a 375 cu-in. event to rival the Thompson Trophy in prestige.

Shortly, upward of a million people will have perched in stands and points of vantage outside the gates, will have craned their necks, parched their tonsils, maybe cheered once or twice, and come away from the Los Angeles Municipal Airport feeling that they

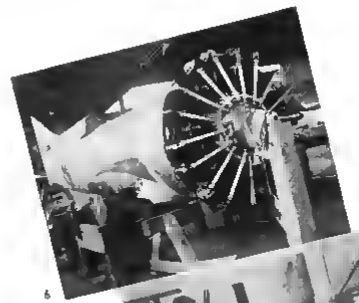
At this writing it does not appear that Bendix entries will be as numerous as before. In 1935, four of the five winners used transport type planes. General opinion now has it that the Bendix is not a race plane event, but rather a contest for transport ships with stratosphere tendencies. Howard won in 1935 and looks like a good bet to repeat with "Mr. Mulligan." Turner's new racer is still far from complete, and seems unlikely to be able to compete in anything earlier than the Thompson. With his rebuilt Wedell-Williams, Roscoe does not rate better than a place back of Howard. S. J. Wittman is an unknown quantity, but will probably save his fire for the Thompson. Frank Hawks and George Haldeman are believed definitely out of consideration. This leaves the race pretty much up to the ladies, and Amelia Earhart (with her stratosphere Electra) and Jacqueline Cochrane Odlum (with a Twin-Wasp Breese Special said to be good for a sustained 277 m.p.h.) both look like good Bendix bets.

The 1937 Thompson should be an all-time classic, with both a new record list of starters and a new speed mark predicted. If Turner gets his new racer in shape, and proves his ability to fly it, he should have at least a 30 m.p.h. margin on the field, except possibly for Detroyat and his Renault-Caudron, which will be a real threat in both the Thompson and Greve races. Earl Ortman will fly the Wasp SIDI-powered Keith Rider in the Thompson only. This is the plane that killed Jim Granger two years ago and has since captured for Ortman the San Francisco-Los Angeles, and Canada-Mexico records. Rated at 300 m.p.h. plus, it should be able to turn in a 260 m.p.h. average (or better) for the Thompson distance. The plane will carry the Gilmore Oil Company colors. It is owned by Al Marcoux and has been completely reconditioned under the supervision of F. J. Roberts.

Of course Wittman will try again with his Curtiss D-12 Special, but it is believed his chances of placing as high as his last year's second are poor. Ben O. Howard will no doubt have "Mr. Mulligan" entered again, but he will be up against real race plane competition in a typical race plane event and is not considered good for better than an outside place. Among the real threats are a number of the 375 and 550 cu.in. Menasco-powered baby racers such as the new Crosby.

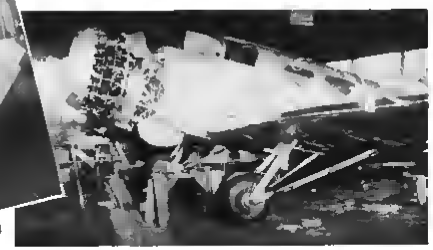
From among the Greve Trophy Race high men it is believed will come a possible Thompson winner, and most of the Thompson placers. Detroyat is, of course, a good bet to take both the Greve and Thompson. His ship is rumored capable of 340 m.p.h. and he is said to be bringing one of the new twelve-cylinder Renaults for the final race event. But the new Crosby racer, if favored by good fortune, is also doped as a better than 300 m.p.h. and, with its new 550 cu.in. Menasco Super-Buccaneer, it is believed a good bet to take the Greve race and give anyone else a tight run for the unlimited Trophy. Not to be overlooked, however, is Howard's "Mike," winner of the 1935 Greve Trophy, or Chester's "Jeep," victor over Kling and McKeen at Denver in July in faster time than any of the 550 cu.in. racers have yet known. The "Jeep" is good for 255 m.p.h. and might hold 240 for the Thompson Trophy distance, which is 20 m.p.h. faster than shown by last year's winner.

Another strong 550 cu.in. contender and Thompson Trophy possibility is the Keith-Rider B6S Buccaneer-powered Special to be flown by Lee Schoenhair and said to be capable of 275 plus. Also Dave Elmendorff has a similar ship, completed by himself. He has proven himself to be a sweet race pilot, so will be out to stay in front. Marion McKeen will have the 550 cu.in. "Miss Los Angeles" in the best shape yet and



6

7



8

Fig. 1—Night view of Elmendorff racer. Only light is one drop cord bulb borrowed from Mrs. Elmendorff. Engine not shown as it is still under assembly just out of picture. Fig. 2—Leading edge oil tank for Crosby racer, one on each side and two spare tanks built and ready if needed. Room for 20 lb. dry ice between rear wall of tank and rear spar if needed for cooling. Fig. 3—Crosby racer (Menasco Super-Buccaneer) near completion with sixteen men on each other's chests trying to get some work done. Fig. 4—Flap gear on Crosby racer. Fig. 5—Tail assembly of Crosby racer. Fig. 6—Wasp SIDI serviced by Ralph Buckley, being reinstalled in Marcoux's Keith-Rider racer. Fig. 7—Marcoux's Keith Rider had complete rebuild on all woodwork. One of finest wing jobs ever turned out. Fig. 8—Candid camera study of Jacqueline Cochrane Odlum's borrowed Vance Breese special with face lifting operation successfully completed to permit use of Twin-Wasp.

won't take a back seat without quite an argument. Rudy Kling has been getting valuable racing experience under his belt and stands a good chance to come through near the top of the pack with his 550 cu.in. Menasco powered Keith-Rider.

Other outstanding 550 cu.in. threats will be found from among the 375 cu.in. racers, where much of the most interesting and seosationsl new plane construction and race plane piloting is anticipated. Chester should win on form with his "Jeep" but will have a whale of a struggle to displace the 1934 champion, Lee Miles with his "Miss Tulsa," nee Miles and Atwood Special. Ralph Bushey's 1934 New Orleans winner has been rebuilt by Tony LaVier and will probably get back in the money again. Harold Neumann has a new 375 cu.in. Menasco racer of mid-wing type built by Clayton Folkerts and may spring quite a surprise. S. J. Wittman also has a new 375 cu.in. Menasco job, and on past performance should be in the money in every race from the Shell to Thompson Trophy. Two new 375 cu.in. entrants will be Allenbaugh, formerly in the 200 cu.in. class, and Buchanan. Allenbaugh has installed a German Argus engine in his baby racer and hopes to take some of the 375 cu.in. money but is up against too much real class to place high. Buchanan is in the 200 cu.in. event and everything else on the program except the Bendix and the feminine events. His racer is much like Crosby's in that the pilot must lie back in a reclining position in order to fit into the tiny fuselage. Unlike any other entrant he will trust to an automobile engine, a 183 cu.in. Miller straight-eight, water cooled engine turning about 9,000 r p m. and geared down 2½ to 1 to the propeller. This plane has never been flown and is to be tested at Muroc dry lakes prior to the race meet. A doubtful starter, if this little flash does run and keep on running, it should have a chance of springing a speed sensation. Like a number of the other racers mentioned, it is considered too dangerous for comfort. Nothing further is known at this writing concerning the other 200 cu.in. entrants.

The usual crowd of sportsman pilots has stepped forward to compete for gold and glory (mostly glory) in the Ruth Chatterton Derby. Everyone in this event should have a lot of fun. As the races are now staged, this event is meaningless, but it is a pleasant sideshow for those in it. As in 1935, there is a race for women on the airport racing program but this will, no doubt, be only a dull spot on the program. The ATC contests as outlined sound as though they might develop significant results for the industry. It is hoped that this phase of the program will be given greater prominence in future.

But no matter what Sept. 4-5-6-7 may bring, most dramatic moments of the races have been seen by Operative 1313X peeking through keyholes at sweating Roscoe Turner, cursing Al Menasco, feverish Crosby and his crew of engineer-mechanics, at frail, blonde, helpless-looking Mrs. Elmendorff holding the dropcord electric light in the wee small hours bossing Hubby and his volunteer mechanics as they fumbled with the intricacies of Dave's sleek speeder, wondering if they had enough change among them to buy one good breakfast.

RACING EVENTS

Vincent Bendix Trophy Race—International free-for-all. New York-Los Angeles, $15,000 purse, $4,500 first, $2,500 second, $1,500 third, $1,000 fourth, $500 fifth, $2,500 for new record, $2,500 for women, must be in Los Angeles by 6 p.m. Sept. 4, with eighteen hours maximum time allowed.

Ruth Chatterton Sportsman Pilot Trophy Race—ATC or Group II Licensed planes with minimum 85 m.p.h. cruising, Cleveland to Los Angeles; $5,000 purse, with $3,000 for intercity handicapped laps, $1,000 each for eastern and western wings; percentage awards from 25 per cent to 5 per cent for each division; handicap based on estimated cruising speed.

Event No. 2—266 cu.in., men, 15 miles, three laps of 5 mile course, 115 m.p.h. qualifying speed.

Event No. 3—Amelia Earhart Trophy Race, ATC handicap; 800 cu.in.; women; maximum speed 175 m.p.h.; 25 miles, five laps of 5 mile course, qualifying speed 100 m.p.h.; purse $1,500.

Event No. 4—Shell Trophy Race; men; 375 cu.in., purse $6,000; 100 miles, twenty laps of 5 mile course; qualifying speed 175 m.p.h.

Event No. 5—266 cu.in. race; men, purse $1,200, 15 miles, three laps of 5 mile course, qualifying speed 115 m.p.h.

Event No. 6—Shell Award; 375 cu.in.; men; purse, $3,000, 50 miles, ten laps of 5 mile course, qualifying speed of 175 m.p.h.

Event No. 7—Louis W. Greve Trophy Race, men; 550 cu.in.; purse $10,000 and Greve Trophy; 100 miles, twenty laps of 5 mile course; qualifying speed 200 m.p.h., $1,500 of purse to winner if present 213 m.p.h. record falls, $3,400 to first place, $2,125 for second, $1,190 for third.

Event No. 8—ATC Race; men; 800 cu.in.; purse $1,000; 25 miles, five laps of 5 mile course.

Event No. 9—Shell Cup Race; men, 550 cu.in.; purse $3,000; 50 miles, ten laps of 5 mile course; qualifying speed 200 m.p.h.

Event No. 10—Charles E. Thompson Trophy Race; men; international free-for-all, $20,000 purse, first $7,000, second $4,375, $2,500 to winner if record falls, 150 miles, fifteen laps of 10 mile course, qualifying speed 225 m.p.h.

Events No. 20, 21, 22—Parachute jumping, purse $200, spot landing contest. There will be one contest each of the last three days, with five cash prizes from 45 per cent to 5 per cent of the purse.

PRE-RACE HIGH-LIGHTS

Most sporting gesture: Refusal of Howard Hughes to enter his DC-1 in the Bendix or his Hughes Special in the Thompson. Hughes insists that he is a strictly amateur pilot. His Douglas would be a near-cinch in the Bendix and, barring engine trouble, his special racer unbeatable in the Thompson. As someone remarked, "You can't beat 120 million dollars."

Outstanding favorite:

Bendix—Ben O. Howard
Thompson — Earl Ortman
Greve—Arthur C. Chester
Shell—Arthur C. Chester

Best long shot:

Bendix—Amelia Earhart.
Thompson — Michel Detroyat
Greve—Harry Crosby
Shell—Lee Miles

Darkest horse:

Bendix—Louise Thaden
Thompson — William O. Buchanan
Greve—William O. Buchanan
Shell—William O. Buchanan
200 cu.in. — William O. Buchanan

Best prepared new racer:

Harry Crosby with Menasco powered 550 cu.in. entrant

Best groomed entry:

Arthur C. Chester with his "Jeep"

Most hectic preparation:

(Tie) Keith Rider with his new Menasco powered Rider special. Dave and Mrs. Elmendorff with their new Menasco powered Rider-Elmendorff special.

By Frank T. Courtney

Land Launched SEAPLANES

Modern flying boats with wing loadings under 30 lb. per sq.ft. have no trouble in taking off the water. If, as, and when loadings are pushed into the 40-50 lb. range, however, some auxiliary launching means may be necessary. Captain Courtney in the following article presents a few possibilities

IT was in the Azores, eight years ago, that I came to the conclusion that flying boats would eventually have to be launched into the air from land. I had been tearing the insides out of my engines trying unsuccessfully to get off the water with a load which I knew I could easily carry in the air. I figured if I could have had a rail track running up the hill behind Horta Harbor, up which my flying boat could be pulled on some kind of beaching and launching dolly, and down which I could run and be launched off over the water somewhat in the manner of a Coney Island "water-chute," I could get away with something like twice the range of fuel that I then had.

Since that time the efficiency of planing bottoms has increased tremendously. But so have the demands on them.

Until recently, British flying boat design has emphasized the necessity of being able to take off very rough seas. This has demanded relatively light wing loading. The result has been poor range—and *range* is more important for flying boats than for land planes. More recent American practice has gone to much higher wing loadings and consequently far greater range. This has justified itself on the grounds that, with such range, the boat can always count on getting out from, and back to relatively sheltered water where high take-off and landing speeds can be used.

But this business of range versus take-off and landing conditions has now gone a lot further. Flying boats are being called upon to compete in transoceanic service with dirigibles which have so much available range that they can cruise around weather they don't like, and even sit about waiting for political upheavals to end before they land. And as things stand at present, heavier-than-air has to choose between carrying a respectable payload and having not nearly enough range for transoceanic reliability, or carrying a pathetically small payload with a range which may, with luck, get them over the oceans on some kind of schedule.

Estimates show that by revising design to give 50 lb. per sq. ft. and 20 lb. per hp. to the modern flying boat in the 25 ton class, it could carry its full normal payload at normal cruising speed for about 3,500 miles instead of its present 1,200 miles or so. As 20 lb. per sq. ft. of the total is in the form of fuel, the plane still lands with the permissible (if slightly high) landing load of 30 lb. per sq. ft. The immense effect of such results on commercial as well as military operations is so obvious that something of the kind is going to be done very soon.

The only problem is, how to get this kind of plane into the air?

It is true that, as flying boats get larger, they show increases in efficiency which will enable them to take off such loads in the normal manner. But there are two objections to waiting for the larger boats. First, they may be excessively large for many immediate commercial operations, and the military

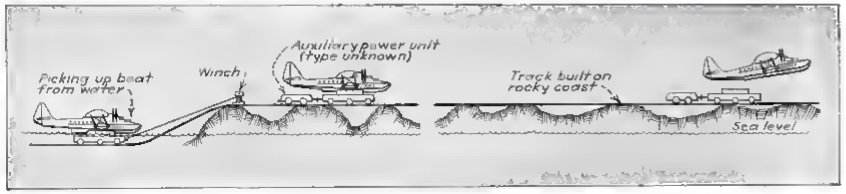


Fig. 1. A possible pick-up and launching arrangement.

people may object to such large baskets for their eggs. Second, even though they take off surely and easily with their very high wing loadings, they must necessarily take a long run at high speed over the water. World flying boat operations will not find many waters like the lagoons and sounds of North America's East Coast where extremely long, unobstructed runs are common. Horta Harbor in the Azores offers adequate space for all reasonable landings, but a long take-off run takes the boat out into seas which only abnormally tough structures (and abnormally tough passengers) could be called on to stand.

Taking our long-range, highly loaded flying boat in the 25 ton class, therefore, it is unlikely that it would be able to make many really practical take-offs in the conventional manner. It is therefore necessary to consider other methods of getting it into the air.

The common catapult, as used by Naval Air services or by the Germans in their South Atlantic work, is one method but obviously it is not adaptable for commercial use on account of the very high accelerations involved. The Short-Mayo composite idea, shortly to be tested in England, may offer another solution. At least it will be watched with interest. But I believe the answer lies in another direction.

As a basis of discussion I am taking some estimates which bring a normal flying boat of 40 000 lb. gross weight and 30 lb. per sq. ft. up to 67 000 lb. gross and 50 lb. per sq. ft. for long range purposes. With high-lift devices and the slipstream, the minimum take off speed will be slightly over 100 m.p.h., which means a practical take-off or launching speed of around 135 m.p.h. or about 200 ft. per second.

A few figures concerning the elementary factors in the case will serve to give a general picture of the problem. Assume our 67 000-lb. flying boat to be mounted on a launching carriage weighing 3 000 lb., and launching speed 200 ft. per sec. We then get:

Acceleration	Distance required	Time required	Maximum hp. required for acceleration
1 G.	620 ft.	6.45 sec.	28,800
½ G.	1,250 ft.	12.50 sec.	12,800
¼ G.	2,500 ft.	25.00 sec.	6,400
⅛ G.	5,000 ft.	50.00 sec.	3,200

These figures do not allow for air resistance or friction, but simply form a general basis for consideration.

Considering first the question of acceleration. It is argued that passengers can stand a horizontal acceleration of about 1 G. But one learns that the average acceleration of a subway train is limited to about ⅛ G. If the poor straphanger can stand this, the man in a well padded seat can probably stand ¼ G comfortably. After that it is a question of what his nerves, not his body, will stand. Probably he can be led fairly gradually up to ½ G. These considerations, plus the auxiliary power question, seem reasonably to limit our average acceleration to somewhere between ¼ G. and ½ G.

This rate will give a launching run of some 2,000 ft. Provision must be made, however, for starting up, for stopping the launching carriage after the airplane has left, and room for slowing up the entire unit if, by reason of some defect or error, the pilot should decide not to take off. This brings the distance required up to around 3,000 ft.

The time required for the take off will thus be around 20 seconds, but this is not important. (I never could understand why flying boat take-offs are measured in seconds—it doesn't mean anything.)

The power required presents many problems. From the airplane's own engines, some 2,500 hp. can be expected at the fast end of the run. But a high proportion of this will be used for air drag and friction. For an acceleration of 1 G the remaining power would be a negligible contribution. The power figures given apply, of course, only if the full acceleration is carried on up to the 200 ft. per sec. Power required would be reduced proportionally with any reduction in acceleration as that speed is approached. On the other hand, the length of run would be increased by such reduction. It is obviously a case of compromise between excessive length of run and excessive auxiliary horsepower.

Another important factor here, however, is the kind of auxiliary power to be used and how it is to be applied. If an electrical, or other engine were used to drive the launching carriage, its weight would have to be accelerated with that of the cradle unit, leading into a vicious circle of more power and more weight. If a very low acceleration with a long run could be accepted an ordinary electric or steam locomotive offers possibilities, and might be applied where an existing railroad track was available.

An attractive possibility might be a locomotive consisting of a light carriage on which was mounted a number of aircraft motors with propellers. For cheapness, slightly out-of-date motors could be used, and they could be run considerably above rated power for the few seconds of their operation. They would provide the kind of power required—increasing with forward speed, there would be no slipping of wheels on the track, and the whole unit would be about as light as could be produced.

Then there is the possibility of towing the launching carriage by means of cables by a stationary engine alongside the track. From the weight standpoint this is the most attractive. But the cable must be very strong, and very heavy to avoid definitely any risk of breakage. The whiplash effect of a cable breaking under a heavy load can do amazing damage. Such a cable would have to go around pulleys, and possibly several pulleys, at 200 ft. per sec. This looks pretty difficult, but mine hoisting-gear has reached a stage where this problem does not seem insoluble. There is no objection to using pulleys of 30 ft. diameter if necessary. Since the power-plant would be stationary, and its weight of no consequence, the provision of adequate power should be easy.

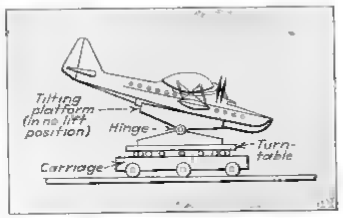


Fig. 2. Schematic arrangement of cradle and carriage showing tilting and turning features.

This brings us to the question of the track itself. I have seen many launching schemes become complicated by attempts to run the airplane into the wind. This is not necessary. The airplane can be mounted on a turntable, rotatable on low-friction bearings. Thus, should the wind be blowing across the track, the airplane on the turntable could be continually turned into the resulting wind, either by the normal stabilizing surfaces, the pilot's use of the rudder, or some other control. Suppose, for example, the track runs north and south, and the wind is from the N.E. The launching carriage runs northwards and the airplane, turning on the turntable, faces somewhat to the right according to wind strength. Similarly, if the wind is from S.E., the carriage runs south and the airplane heads leftwards. Of course, when the airplane leaves the carriage it will be crabbing over the ground—but it will be heading into the air.

The possibility of using one track is highly important. It means that a base for long-range flying boats can be built wherever there is a place to build a mile or less of track and sufficient lee for a flying boat to descend in its light condition. No long run of protected water is necessary for take-off. And every flying-boat pilot knows of lots of places where he can come down but where he wouldn't attempt to take-off. By this system, the track would run down into the water, the launching carriage would run down to pick up the flying boat in the manner of a beaching dolly, the whole unit would be hauled up to the level for connecting to the propulsive mechanism, and the boat would be loaded up.

The act of launching would have to be something much better than is normally provided by the conventional catapult, which leaves the pilot with little say in the matter until it is too late to say anything. Take off speeds will be too high, and the class of load carried too sensitive, for the risks of such casual treatment. I believe it is possible to make the whole of this operation perfectly safe from the highest commercial standpoint, and to place it completely under the control of the pilot, without outside assistance and with little or no departure from his ordinary take-off routine.

Suppose that the platform on which the airplane is mounted is not only free to rotate the airplane into the wind, but is also able to rock fore-and-aft in the pitching sense of the airplane. The carriage gathers speed with the airplane pitched forward at a non-lifting angle. When the pilot sees, from the air-speed indicator, that he has reached his take-off speed, he pulls back on the elevators, the airplane and platform rock back, giving the necessary incidence for take-off. Should a holding-down device be necessary, it could release the airplane automatically by the same rocking-back motion of the platform.

Through a multiple electric plug (which would pull out when the airplane left the carriage) the pilot could open up or shut down the external auxiliary power through a throttle connection, apply brakes if he decided not to take-off, or, if necessary, mechanically operate the motions of the platform through connections with his elevator or rudder controls. Signals beside the track would warn the pilot of his maximum safe run. There is no reason why these and similar arrangements should not provide complete safety and reliability for such a launching.

The immense value, commercial and military, of the increase in range which would be made possible by some such launching system, added to the fact that it would make it possible to operate long-range boats from places where it is not now normally possible, would justify a great deal of expenditure and study in this connection.

Although these notes have referred mainly to flying-boats on account of their usually greater need for long range and their greater difficulty in taking off with great loads, the general principles described above apply also to the launching of landplanes.

* * *

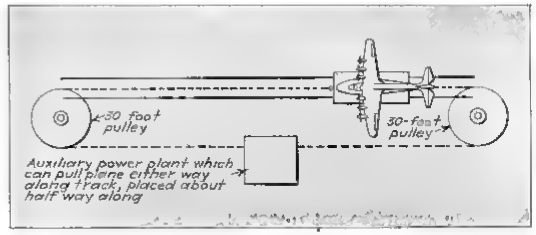


Fig. 3. Plan view of cable system showing how power plant might be made stationary and located alongside of track.

Authenticated

HANDLEY PAGE

turns out a medium bomber for Britain's Royal Air Force. Its exceptionally clean lines are helped by the provision of a completely retractable landing gear. Power is from two Bristol Pegasus X 900 hp. engines.

We get the business because WE KNOW THE ANSWERS

By O. J. Whitney
Pres., O. J. Whitney, Inc.

Charter operation with a plan and purpose brings results and revenue

THE telephone in my office rang. A long distance operator announced that Canadian Airways was calling from Montreal. The conversation was as follows:

"Can you pick up a passenger here who must be in New York by 6 o'clock tomorrow morning?"

"Certainly."

"What is the weather?"

"Zero-zero at Bear Mountain, New Hackensack, and Armonk, but we know the fog will not extend above Poughkeepsie and will burn out after sunrise."

"Can you arrange for our passenger to clear the customs?"

"Yes, at Swanton, Vt., where there is an inspector on 24-hour duty within 2 miles of the airport. We will wire him to advise of our arrival."

"What's the fare?"

"$321."

"Thank you, we will check the price with our passenger and call you back. Good-bye."

A glance at the office clock showed it was 11:30 p.m. Canadian Airways called back at 11:40 with their O.K. and we took off for Montreal at 12:10. We could have started earlier if it had been necessary. Our arrangements worked perfectly. After waiting 45 minutes for our passenger we were back at North Beach at 5:20 a.m. This typical incident illustrates several things.

Answers From Diary

First we make it our business to know all the answers and can give them without hesitation. This is not as miraculous as it might seem. Some of the information is based on individual experience. Most of it is based on our collective experience as recorded in our plan book—a bible that is kept within reach at all times and can be opened to any page quickly with one hand while the other holds a telephone receiver.

The practice of keeping a diary is one of questionable discretion in these modern times but we find ours indispensable. In it we record all of the intimacies of our daily life—that is those relating to flying operations. When we fly over a field we note its condition. If a New York-Buffalo passenger has been conditioned to favor the "water level route" and objects to flying directly across the mountains, we make a note of it. If an area has a habit of fogging-in in the small hours of the morning and clearing when the sun comes up we note it. And all our notes are accurately recorded immediately in our "book of knowledge" which serves us so well when the telephone rings. It enables us to answer all questions with a positiveness that dispels any hesitancy the prospective passenger may have. And if conditions are bad we tell the truth. We would rather scare him before than "during."

In this same plan book we have a copy of our rate structure which is constantly revised by experience and formula and to which we adhere inflexibly. Our rates are based on operating cost per mile derived from past experience as recorded in detail in our files. In computing mileage we consider the possibility of a passenger requesting an alternate route (such as New York to Buffalo via Albany) and attempt to predict how often this will occur on the basis of past experience. Then we adjust the mileage and the rate accordingly.

This actuarial method of computing rates is only one example of our efforts to foresee and provide for every possible eventuality. Another is the provision of high speed stand-by equipment. For example, Graham McNamee recently chartered a ship to attend the Maryland Jumps. A mechanical difficulty necessitated an unscheduled landing at Trenton. We were prepared for this mishap by having an extra Beechcraft available. Because of its high speed it was at Trenton in a matter of a few minutes and we were ready to resume the flight.

We carry complete insurance coverage on all our equipment for all purposes. The necessary expense is really a wise investment not only because of the protection afforded but because of the frequent inspection of ships, shop, and personnel which is carried on by the insurance companies. This provides a check in addition to the regular Department of Commerce inspections, and as such, has proved of very valuable assistance to us in the everyday routine of our business.

This quality of service increases overhead and therefore rate but it is our policy to provide the most dependable service possible anywhere, at any time. Naturally it costs more to run a business that way than it would to operate on a haphazard basis but we find the prospective purchaser usually is willing to pay the price. If he isn't we have another use for him. We turn him over to one of the operators to whom we have sold an airplane. Usually the one-plane charter operator is able to give some price concession because his overhead and operating costs are lower. He cannot furnish the expensive assurance of standby equipment, 24-hour service, and other elements of maximum dependability but in cases where there is some leaway in time and cost is a consideration his service is satisfactory. This arrangement helps our airplane purchasers who are trying to get started and it helps us when the time comes for them to buy more planes.

And that leads to an analysis of the types of people who use our service.

Who buys charter service?

Primarily we are interested in the prospect in the higher income brackets who is not concerned with cost but insists on a dependable service. To reach him we must keep our name constantly before him in his native haunts—hotels, clubs, steamships, etc. That means we must go to town. We have never gotten a job from the airport.

The ways and means of getting our story in the right places are numerous. Backlog of our traffic sales organization is a salaried salesman in New York City who calls on hotel men, club employees, steamship pursers, travel agencies, in fact anyone who has anything to do with selling transportation, and calls on them continuously. Naturally he concentrates on our 45 accredited agents in strategic places in the city but he doesn't stop there. He contacts new ones every day. He joins hotel and traffic men's associations and so do I. And we take an active part in their meetings and deliberations. We stage an occasional beer party, chicken dinner, or clambake at the airport for hotel porters and traffic men and we go far out of our way at other times to get them to come out to the field and fly in our ships. Only by showing them first-hand what we have to sell can we expect them to be our boosters.

Most of our pilots are college graduates and some of them engineers. We feel that this is an important requirement. But like all other men they become dis-

The airplane is ready when the limousine arrives and there is no delay in giving the pilot his necessary "sailing orders."

Fueling and other phases of operation are carried out as on a scheduled airline

couraged when business begins to fall off in the winter. So, like Henry Ford, we increase their salaries when things look the worst and it has a remarkable effect on slow season traffic development for each pilot must be inherently a salesman

When pilots lay over away from the home base they are instructed to make use of their evenings in traffic missionary work. They begin at their hotel by contacting the managers and transportation men, selling them on our service. I had an interesting experience in this type of work one night in one of the largest hotels in Philadelphia.

According to our regular practice I began to work on one of the hotel clerks When I mentioned the words "airplane charter" he threw up his hands in horror. It seems that one of his best customers had wanted to fly to Easton, Pa. The clerk arranged the flight with a local operator and pilot and passenger wound up at Richmond, Va

This story gave me the opportunity I wanted to sell our quality of service. Before I got through I had the hotel clerk believing firmly as I do, that hotels that do not have connections with reliable charter services are second rate If they wish to give the best of everything, it is their duty to their guests to maintain relations with the best operator they can find. Therefore we are as important to them as they are to us

Two other classes of people are objects of our cultivation—customs officials and steamship pursers We know all ports of entry and their respective officials and we know the individuals well enough to know their attitudes toward their jobs This is of invaluable assistance in quick clearances Much of our business originates with steamship pursers A passenger confides in one of these gentlemen his hope of making some difficult transportation connection after landing We have performed the impossible for many of them.

Maintenance of airplanes and engines follows airline practice

Fleet and Personnel of G. A. Whitney, Inc

Ship chasing

In more than a dozen cases we have put passengers aboard ocean liners up to two hours after sailing through the cooperation of steamship officers On one occasion we cooperated with United Air Lines in getting a mother and twenty-month old baby, who wanted to be home by Christmas, aboard the S S "Gripsholm" The ship had sailed before the Eastbound United plane had left Chicago but we had no difficulty in making the transfer.

Another use for amphibian equipment is found in providing commutation service for men who spend their summers on yachts under way We pick up our passengers in the morning and are informed of the proposed position of the yacht that evening in advance or by radio We catch up with the boat and usually deliver our passenger in time for dinner, if he wants dinner aboard

News and newsa photo agencies constitute an important class of customer During the International Yacht Races we flew the films to the 31st Street Seaplane Terminal and tossed the films ashore. Our amphibian stood by while the contact prints were made and we picked them up and delivered them to an outgoing steamer some distance off shore. We have developed a unique system to drop packages on moving ships by using a cord with a brick attached to the end The plane slows up and drops the brick on to the bow. It is picked up by a member of the ship's crew who guides the package to the deck. Our percentage of hits by this method is quite large.

For ground transportation we maintain two limousines and we encourage passengers to use them not because of the revenue involved but because our drivers know the short cuts to the airport.

Our business expansion has proved our philosophy that charter service can be made to be profitable if it is developed on the basis of logical long term planning and if your answer to the inevitable question of all prospects "How soon can I go?" is "How soon can you get to the airport?"

Pressure—Current—Time

ON THE SPOT

Last month the author discussed equipment and operating technique. Herein he makes a study of the three primary variables that affect the quality of the work.

Part II of an article on spot welding aluminum alloys in production.

By C. WESTON STEWARD

Chance Vought Aircraft
Division United Aircraft

IN the latter part of 1935 a study was made by the author of available data on the proper values of time-of-current flow, electrode pressure and weld amperage for welding aluminum alloys by the spot (i.e. resistance) welding method. Considerable difference of opinion was found among the several authorities on the subject, but there was definite agreement that very short timing was imperative for thin materials. For example, .012 to .016 in. thicknesses should not be welded on more than one cycle (60 cycle a.c.). It was maintained that longer timing would cause the molten zone to extend to the surface which would result in cracks, brittleness and poor corrosion resistance It appeared that accurate timing, including ½ cycle, was absolutely necessary for good results As the thickness increased the recommended timing increased until 8 to 10 cycle was used for .125 stock.

The available sources of information were the Aluminum Company of America, Wright Field Report No. M-56-2597, P R Mallory & Company, and the Boeing Airplane Company. The first three were in fairly close agreement on time vs. thickness of material Boeing used somewhat higher values. A comparison of these values is shown in Fig. 1. The Army and Boeing research, however, did not go beyond .051 stock.

A study of the other variables indicated that the most critical one was welding current That is to say, with all the other variables constant, the amperage could be varied the least without causing trouble It appeared that changes in pressure had an effect on the required amperage; i.e. the higher the pressure the higher the required amperage The pressure in itself, however, was not critical, except in the lower values It can be seen from Fig. 2 and Fig. 3 that Boeing used higher pressures and higher amperages for a given thickness than did Wright Field and the other sources Data found in Wright Field Report No. M-56-2597 indicated that practically the same results could be obtained at higher than the recommended amperage if the pressure was increased accordingly. This was confirmed by research at the Boeing Company The pressures recommended by Wright Field were evidently arbitrarily established and the other variables modified to suit.

Information from the Aluminum Company indicated that electrical resistance between the sheets varied asymptotically with the pressure, approaching a constant value at the higher pressures The resistance did not begin to level out until about 400 lb which was, therefore, taken as the minimum electrode pressure recommended. The Boeing research indicated that better results were obtained with much higher pressures than the Air Corps recommended, the advantage being a wider range between the amperage at which the parts would just stick and that at which spitting occurred (indicating too much heat)

Regarding the fourth variable, surface condition, both Wright Field and Boeing agreed that surface condition had a very definite effect on control of the quality of the spots The Aluminum Company was more of the opinion that proper cleaning of both faying and external surfaces was not always necessary In fact when Alclad was used they maintained that no cleaning at all was necessary other than to wipe off the surfaces with a cloth

With the above data available and the new equipment installed, as described in the previous article, (AVIATION, August, 1936, p 29), it was felt that the stage was set for production work Most of the difficulties encountered in production were described in the previous article There still remained one or two conditions that were not satisfactory, the major one being reliability with

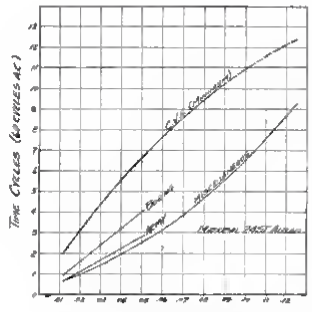


Fig 1—Comparison of Values for Time of Current Flow recommended by various authorities.

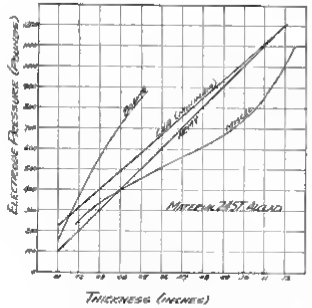


Fig 2—Comparison of Electrode Pressures recommended by various authorities

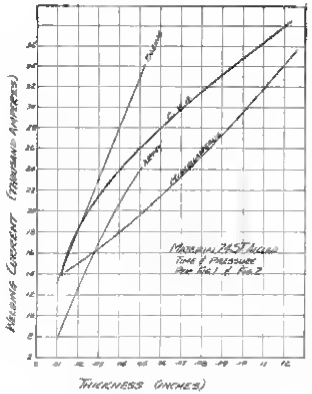


Fig 3—Comparison of Weld Amperages recommended by various authorities

the thin materials and it appeared necessary to do some more research work in this field

There was some indication, as the work progressed, that longer timing might be better for thin materials It was decided, therefore, to study this variable more thoroughly It was soon apparent that beyond 2 or 3 cycles no appreciable change in weld amperage was necessary as the timing was increased A further study indicated that this was not peculiar to the very thin materials, but in principle, was true for all gages—the only difference being that, as thickness increased, the leveling off point occurred at a proportionately higher number of cycles. This is shown in Fig 1 The curve marked C.V.A. shows the number of cycles above which the required weld amperage does not change appreciably in order to produce a good quality spot Below the values shown there is likelihood of trouble from porosity and cracks due to insufficient time for the molten zone to fuse properly This is illustrated in Fig 4 which shows the effect of timing on 064 in Alclad, 24ST at constant pressure and amperage

It will be noticed that below 6 cycles there is evidence of porosity Contrary to previous information, the bubble appears to grow parallel to the surface rather than normal to it The 10 cycle spot is no nearer to the surface than is the 1 cycle spot. Very satisfactory spots have been made in 012 and 016 in Alclad, 24 ST, using 10 cycle timing In fact the author locked the timing control box at 10 cycles for a period of more than a month so that all work had to be done at that setting A definite improvement in the work was shown, especially with the thinner materials

In order to determine what effect longer timing had on the shear strength of the spots a study was made of spot weld strengths vs. weld amperage for a given thickness at constant pressure Fig 7 shows the results in 016 in Alclad, 24ST The dotted portion of the curves shows the amperages at which the quality of the spot is not considered satisfactory because of porosity—cracks or the bubble coming to the surface It will be noted that the dotted line starts at a higher amperage for the 10 cycles than it does for ½ cycle. Repeated tests have shown that small cracks in the center of a spot can be prevented by increasing the timing only, keeping the same pressure and amperage

Thus, for all practical purposes, the timing may be kept constant at 10 cycles It is obvious that this is a definite advantage in simplifying matters for the operator and it is being found in production that it improves reliability

Of the four original variables, namely, surface condition, time, pressure, and amperage, the first two could now be reduced to constants There still remained pressure and amperage for further investigation. Confirming the findings of others, it was found that pressure was not critical, except in the lower values Keeping time and thickness constant, it was found that for strong alloys below 064 in thickness, the required amperage approached a constant value as the electrode pressure approached 1,000 lb.

Electrode pressure

In Fig 5 is shown a series of spots in 064 in Alclad 24ST which was made at constant time of 10 cycles, constant amperage of 26 870, with electrode pressure varying from 300 lb. to 1,150 lb. This shows clearly that the bubble varies in size inversely proportional to the pressure There is some indication that the structure of the spot is more compact at the higher pressures The author has produced spot welds of good quality and high shear strength, however, in thicknesses ranging from 012 in. to .064 in by keeping the pressure constant at 400 lb and the time constant at 10 cycles For work which is not as exacting as aircraft manufacture, a machine operating on a fixed timing of around 10 cycles and 400 to 500 lb electrode pressure would be quite satisfactory But at present, it is felt that the quality of the spots should be as near perfect as possible for aircraft use. Consequently, the pressures should be as near right as we can make them

This brings up the question of whether or not there is a one best pressure for each thickness It would seem, on one hand, that pressure should be high for the sake of producing a finer grained structure On the other hand, it happens that excessive pressure on thin sheets causes what might be called embossing because of the raised appearance of the spot It also happens that lower pressures permit correspondingly lower amperages which in turn make for longer tip life. Obviously, the correct pressure is the lowest that will insure against porosity The pressure curve C V A (Fig. 2) shows the minimum pressures found best at Chance Vought Aircraft. It must be kept in mind, however, that most of the work requires one side to be smooth. When dimpling on both sides is permissible, the pressures may be increased somewhat.

It is of interest to note that a change in pressure may be utilized in lieu of a tap change on the auto-transformer when such a tap change involves too great an increase in weld amperage. This may be done by going to the higher tap setting but increasing the pressure, which reduces the bubble to the size desired

Regarding the proper welding amperage, all values published either here or elsewhere are believed to be relative only They are given as a means of indicating the relation of weld amperage to thickness of material The methods for calibrating the output of the equipment are somewhat inaccurate When an oscillograph is used, for example, the readings must be multiplied by a total transformer turn ratio of as much as 6,000 in some cases, so it is obvious that a little misjudgment in reading the oscillograph deflection can make quite a difference in the final answer There is some consolation, however, in the probability that if the points fall on a smooth curve the calibration is somewhere near correct. In plotting a curve of weld amperage vs thickness, data should be used from a large number of tests made at different times, and the average values used This is because the cleanness of the electrodes, where they are gripped by the clamps, has a noticeable effect on the output of the machine A change from the vertical to the inclined position of the electrodes also has an effect For these reasons, the operators are not expected to follow rigidly the charts posted but are allowed to make slight changes where necessary They are expected to know when a spot is a good spot and to watch the work constantly and make the spots just as "hot" as they will stand This is generally just shy of the amperage which will cause "splitting" between the sheets as indicated by a distinctive metallic "pop" Frequent samples are also made and pulled apart by the operator to confirm his aural evaluation

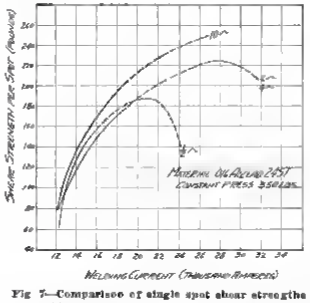


Fig 7—Comparison of single spot shear strengths vs weld amperage at different timing. Dotted portion of curves indicate amperage at which quality of spot is not satisfactory because of porosity, cracks or the bubble coming to the surface

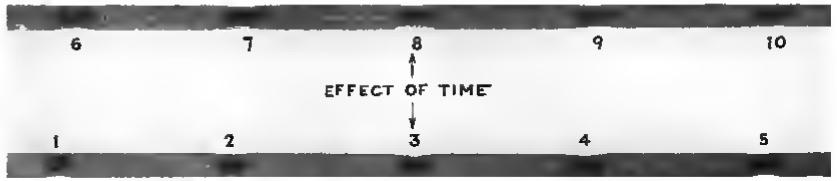


Fig 4—Macrograph showing the effect of changes in time of current flow Amperage kept constant at 26,870 and pressure constant at 620 lb Material .064 in Alclad 24ST

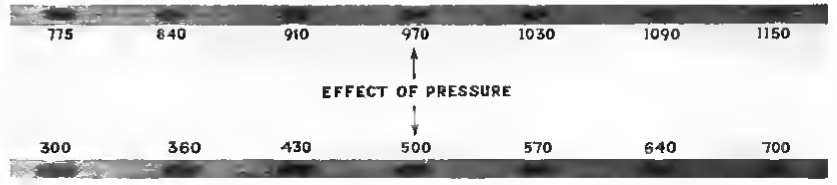


Fig 5—Macrograph showing the effect of changes in electrode pressure Amperage kept constant at 26,870 and time constant at 10 cycles Material .064 in. Alclad, 24ST

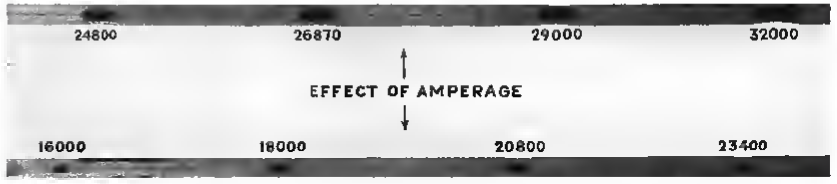


Fig 6—Macrograph showing the effect of changes in weld amperage Electrode pressure kept constant at 620 lb. and time constant at 10 cycles Material .064 in Alclad, 24ST.

The curve C.V.A (Fig 3) shows average values of weld amperage with relation to stock thickness when the pressures and timing shown in Figs 1 and 2 are used Fig 6 shows, macrographically, the effect of amperage changes on the shape and size of the bubble In this case it may be seen that the bubble increases in size with increase in amperage and that the bubble grows both parallel and normal to the surface

It should be kept in mind that the curves shown in this article are based on work with 24ST Alclad of equal thicknesses

Post Prominently!

A set of fire prevention rules that would do well as a part of the Bible of every airport operator

By M. G. Bishop

YOUR airport is a center of public interest. Thousands of people visit it annually and you must protect their lives and property and safeguard their implied confidence.

You yourself have an investment of thousands of dollars in materials and equipment. You must protect it and the lives of your employees.

Toward this end the following precautionary fire rules have been assembled. You should urge all airport personnel to study them carefully and thoroughly.

Smoking and open flames

Since the fire hazard created by smoking is multiplied by the presence of the general public, you are requested to watch members of the public while in prohibited smoking areas. Always be tactful and courteous but firm in requesting visitors not to smoke in such areas.

1.—No smoking will be permitted within 50 ft. of the following: (*a*) any hangar, (*b*) paint shops; (*c*) dope shops; (*d*) storage building or area; (*e*) hose pit, (*f*) gasoline truck, can, or drum, (*g*) oil, grease, paint or dope can or drum; (*h*) aircraft.

2.—Smoking may be practiced in (*a*) terminal buildings; (*b*) offices; (*c*) outside of areas mentioned above.

3.—Never discard matches, cigar or cigarette butts or pipe ashes without making certain that each bit is completely extinguished.

4.—To avoid blowing sparks never smoke on the windward side of any area mentioned in 1 above or in the slipstream of an aircraft.

Open flames, like smoking, create an extended fire hazard. At any time from lighting, during use, and until completely extinguished any of the open flames we use may ignite a fire.

1. No open flame equipment of any kind will be used except by specially qualified personnel and then only with the greatest of precautions and within areas set aside for that purpose.

2. No flares, smudge pots or lanterns will be lighted within 50 ft. of any aircraft, building, storage area or fueling equipment.

3. Trash will not be burned except as, when and where designated by the management.

4. Motors will not be run within 50 ft. of any other aircraft, building or storage area.

Electrical Sparks

Although usually of brief duration, electrical sparks create a very intense heat and make one of our greatest fire hazards.

1. Inspect all wiring regularly and report any faulty installations to the management.

2. Make no temporary electrical connections without authority.

3. Never use any electrical equipment which is dirty, faulty or not completely dry.

4. Exercise greatest precaution in making or breaking connections at sockets or plug-ins and in opening and closing switches, particularly exposed knife-type switches, that the surrounding area is dry and free from any inflammable materials. Always make certain that the connection is well made or completely broken.

5. Electrical equipment will only be used by or upon the instruction of qualified personnel.

6. Magnetoes will be repaired only by qualified personnel and such work will be performed only in the magneto shop.

7. Batteries and radio equipment will be installed and removed from aircraft only by qualified personnel.

Static Electricity

Static electricity is generated by the friction of two materials, a material and a gas or two gases. The friction between the metallic materials of an aircraft and the air while in flight will generate static electricity. The static electricty thus generated is stored up in one or both of the materials where it remains until reabsorbed into the atmosphere or discharged by grounding.

1. Ground all aircraft immediately after arrival and leave them grounded until just prior to departure. Do not touch or commence work on any aircraft until it has been well grounded.

2. Make certain that all equipment (metal-lined hose, funnels, etc.) and the aircraft itself is well grounded before refueling.

3. Make certain that all tank-trucks, drums and storage containers of gasoline are always grounded.

Spontaneous Ignition

Spontaneous ignition is the most sinister of fire hazards. From the least suspected places these fires appear. They are caused by a chemical action generating heat in a confined area. The one and only prevention is ventilation.

1. Keep all areas as well ventilated as possible.

2. Never leave a rag or piece of waste material or clothing which has been saturated with gasoline, oil, grease or paint wadded. Nor should they be placed in a trash container until they have been spread, aired and thoroughly dried.

3. Never allow trash or waste material of any kind to stand in a pile or in a container. Trash and waste material should be placed in the containers provided for such and the containers emptied as often as necessary, at least at the end of each day's work. No container should be allowed to stand overnight.

4. At all times keep all areas clean and free from trash.

Flint Sparks

Although a flint spark is of brief duration and not generally of intense heat, it is nevertheless very capable of igniting fires. The sand and gravel used to make concrete contains a great amount of flint rock thus making concrete areas a special point of precaution.

1. Keep all concreted areas (floors, platforms, aprons, etc.) clean of gasoline, greases, oil and paints at all times.

2. Never throw or slide a tool or metal object across a concreted area.

3. Use the greatest of care in handling drums in a concreted area and store such only on a dirt or wood deck.

4. Avoid the dropping of tools or metal objects in a concreted area.

A simplified study of the lateral motions of an airplane at high angles of attack

TO SPIN OR NOT TO SPIN

By OTTO C. KOPPEN
Aeronautical Engineer,
Massachusetts Institute of Technology

THE TYPE of lateral motion to which an airplane is subject at high angles of attack is extremely important to the operator, and there has been an increasingly insistent demand that flying characteristics at those angles be improved. The usual method of dealing with this problem is to assume the one moment component the damping of roll, is the cause of the sometimes vicious lateral motion at the stall and, consequently, all efforts to improve the motion have been attempts to keep the damping of roll from changing its sign. The importance of the facts that the damping of roll is only one of six lateral moment components acting, and that the airplane motion is the result of the combination of all six, has apparently been entirely overlooked.

With designers and government agencies in wide disagreement as to what constitutes lateral stability, Professor Koppen has taken the problem in both hands and has stripped it down to its essentials to see just what makes it tick.

When an airplane is disturbed laterally, three moments are created; one due to sideslip velocity, one due to angular velocity about an axis parallel to the wind direction, and one due to an angular velocity about an axis perpendicular to the wind direction. For convenience each of these moments may be resolved into components along the horizontal and vertical axes. hTe motion of the airplane depends upon the summation of moments about the axes, and the question of whether or not an airplane will tend to return to equilibrium after a disturbance depends entirely upon the direction of this residual moment.

Of the rolling moment components produced by the motion of the airplane the rolling moment due to rolling velocity is the only one that cannot produce a restoring moment; it acts only to increase or decrease, according to its sign, the existing rolling velocity. However, the moment components due to sideslip and yawing velocities can produce either restoring or upsetting moments depending upon the directions of the velocities that produce them.

For instance, if, while rolling a conventional airplane sideslips toward the high wing, the rolling moment produced by the sideslip will increase the rate of roll. Naturally, this rolling moment is reversed when the machine sideslips in the opposite direction. In the same way the rolling moment due to yawing velocity can be either a righting or an upsetting moment, depending upon whether the downgoing wing is advanced or retarded.

Lateral Motion at High Speed

If there were no yawing moment due to rolling velocity—a condition that is approximated in flight at angles of attack below the stalling angle—the rolling moments due to sideslip and yawing velocities would always oppose each other. This follows from a consideration of the airplane yawing moments due to these velocities. When an airplane is sideslipped, a yawing moment is produced by the sideslip velocity, and this moment turns the airplane about its vertical axis. If the airplane is "directionally" stable, the wing toward which the airplane is slipping will be retarded. The rolling moment due to sideslip will then act in the direction to raise the forward wing, but since that wing will be retarded by the yawing moment due to sideslip, the rolling moment due to the yawing velocity will tend to depress it. Consequently, under these conditions, the moment acting to rotate the machine about its horizontal axis at the start of the motion will be the difference of the two moments acting.

This moment will be a restoring moment when the rolling moment created by the sideslip velocity is greater than that produced by the yawing velocity. Experience indicates that whether or not the difference of moments is a restoring moment is unimportant. The important point is that the resultant of the moments is the difference of the two large moments acting.

Lateral Motion at Low Speed

The situation at the stalling angle is quite different. Here the yawing moment of the wing due to rolling velocity cannot be neglected. This yawing moment is now large and in the direction to retard the downgoing wing. These changes produce outward sideslip velocity with the result that the rolling moments due to sideslips and yawing velocities combine to produce a very large upsetting moment. The effect of this condition is aggravated by the lack of damping of roll at high angles of attack, and consequently the resulting divergence is extremely rapid. This rapid divergence must be avoided if the motion is to be satisfactory.

Design Requirements

The yawing moment characteristics for a given flight condition should then depend upon the direction of the sideslip velocity to be expected in that flight condition. Since this direction changes between high and low speeds, it be-

comes necessary to compromise between the two flight conditions.

At the low angles of attack when the sideslip velocity is inward, it is desirable to maintain as high a rate of sideslip as possible. The most favorable balance of rolling moments will then be obtained, for the restoring rolling moment due to sideslip velocity will be large and the upsetting moment due to yawing velocity will be small. The large sideslip velocity desired for this flight condition will be obtained when the yawing moment due to sideslip is small and the yawing moment due to yawing velocity is large. If the airplane is designed to meet these requirements, there will be only a small tendency for it to turn into the relative wind and that tendency will be opposed by the large resistance to yawing.

When the sideslip velocity direction is reversed, conclusions as to the most desirable combination of yawing moments must be changed. Since, at high angles of attack, the designer has practically no control over the size of the rolling moment due to sideslip, and since, in any case, it would be undesirable to reverse its direction, this moment can no longer be counted upon to act as a restoring moment. The only other possible restoring moment is that due to yawing velocity, and this moment will act in the desired direction only when the yawing velocity opposes the direction in which the machine is banking. This condition can be fulfilled only when the yawing moment due to sideslip is larger than the yawing moment due to rolling.

The desirable design condition for this type of motion is the reverse of that at low angles of attack; the yawing moment due to sideslip should be large, and the damping of yaw small.

In making the compromise between the two flight conditions, it seems advisable to favor the high angle of attack case. An increase in the yawing moment due to sideslip at low angles of attack has a relatively small effect upon the rate at which the motion increases. Moreover, at low angles of attack the lateral controls are very effective in stopping this type of motion. However, at high angles of attack, small changes in the airplane yawing characteristics are likely to produce large changes in the rate of roll. To further complicate matters, in this flight condition, the lateral controls are relatively ineffective.

Mathematical Analysis

The following mathematical analysis is included to substantiate the assumption that the chief difference between high and low angle of attack spiral motion is the direction in which the machine sideslips. The expression for force equilibrium while the angle of bank is changing in a turn without sideslip is developed. A corresponding relation is obtained from the rolling and yawing moment equations. Then, if the yawing acceleration obtained from the moment equations is less than that required for no sideslip by the force equilibrium, the airplane will slip inward and outward sideslip will be produced when the yawing acceleration is greater than that required by the force equilibrium.

Force Equilibrium

There will be no sideslip in a turn when

$$Tan\,\phi = \frac{V^2}{Rg} \qquad (1)$$

where ϕ = the angle of bank
V = the velocity along the flight path
R = the radius of curvature of the flight path

The angular velocity about a vertical axis may be written

$$\omega = \frac{V}{R}$$

and the angular velocity about the vertical airplane axis then is

$$r = \frac{V}{R}\cos\phi$$

Substituting this value in (1)

$$\sin\phi = \phi = \frac{V}{g}r$$

If no sideslip is to be produced while the angle of bank is changing the necessary relation between the yawing acceleration and the rate of change of angle of bank is

$$\frac{dr}{dt} = \frac{g}{V}\frac{d\phi}{dt}$$

If the assumption is made that the flight path is level during the motion, the rate of change of angle of bank is equal to the rolling velocity. Consequently

$$\frac{dr}{dt} = \frac{g}{V}p \qquad (2)$$

Moment Equilibrium

The equations of motion about the horizontal and vertical axes, for the case of zero sideslip, may be written

$$\begin{aligned} \frac{dp}{dt} - p\,lp - r\,lr &= 0 \\ \frac{dr}{dt} - p\,np - r\,nr &= 0 \end{aligned} \qquad (3)$$

where lp, np, lr, and nr are angular accelerations caused by unit velocities of p and r. The coefficients used are in a non-dimensional system in which the unit of time is

$$t = \frac{1}{g}\sqrt{\frac{W}{S}\frac{C_L}{\rho}} \text{ seconds} \qquad (4)$$

and the unit of length is the wing semi span.

Writing $\frac{d}{dt} = D$, the equations of motion become

$$\begin{aligned} (D - lp)\,p - r\,lr &= 0 \\ -p\,np + (D - nr)\,r &= 0 \end{aligned} \qquad (5)$$

These equations will have a solution other than the useless one of $p=0$, $r=0$, when the ratio of the coefficients of p and r are the same for each equation or

$$\frac{D - lp}{lr} = \frac{np}{D - nr} \qquad (6)$$

The values of D necessary to fulfill this condition are

$$D^2 - (lp + nr)D + lp\,nr - np\,lr = 0$$

$$D = \frac{lp + nr}{2} \pm \sqrt{\left(\frac{lp + nr}{2}\right)^2 - (lp\,nr - np\,lr)} \qquad (7)$$

The solutions of the equations of motion then are

$$\begin{aligned} p &= C_1 e^{a_1 t} + C_2 e^{a_2 t} \\ r &= K_1 C_1 e^{a_1 t} + K_2 C_2 e^{a_2 t} \end{aligned} \qquad (8)$$

where a_1 and a_2 are the values of D obtained from (7) and K_1 and K_2 are the corresponding ratios of the coefficients obtained from (6). The values of K_1 and K_2 are

$$K_1 = \frac{a_1 - lp}{lr} = \frac{np}{a_1 - nr} \qquad (9)$$

$$K_2 = \frac{a_2 - lp}{lr} = \frac{np}{a_2 - nr}$$

The desired relation between $\frac{dr}{dt}$ and p can now be obtained by substituting typical values of the coefficients. In the following analysis this is done for two angles of attack, $\alpha = 5°$, corresponding to high speed flight, and $\alpha = 16°$, for flight at the stall.

High Speed Flight

Case I

$\alpha = 5°$ $\quad np = -.286$ $\quad nr = -0.80$
$C_L = 0.25$ $\quad lp = -8.50$ $\quad lr = +1.70$

$$D = -\frac{8.50 + 0.8}{2} \pm \sqrt{\left(\frac{8.5 + 8}{2}\right)^2 - (8.5 \times 0.8 + .286 \times 1.7)}$$

$$D = -4.65 \pm \sqrt{14.4} = -4.65 \pm 3.79 = -8.44, \quad -0.86$$

$a_1 = -0.86$, $\quad a_2 = -8.44$,

$$K_1 = \frac{-0.86 - 8.5}{1.7} = 4.47,$$

$$K_2 = \frac{-.286}{-8.44 + 0.8} = 0.374$$

$$p = C_1 e^{-0.86t} + C_2 e^{-8.44t}$$

$$r = 4.47 C_1 e^{-0.86t} + 0.374 C_2 e^{-8.44t}$$

$$\frac{dr}{dt} = -3.84 C_1 e^{-0.86t} - 3.16 C_2 e^{-8.44t}$$

If a rolling disturbance of 0.1 radian per unit of time is assumed to be applied to the airplane to start the motion, the constants C_1 and C_2 become

$$\begin{aligned} 0.1 &= C_1 + C_2 \\ 0 &= 4.47\,C_1 + 0.374\,C_2 \end{aligned}$$

$$C_1 = -\frac{0.374}{4.47}C_1 = -0.0837\,C_2$$

$$C_2 = \frac{0.1}{0.9163} = 0.1091, \quad C_1 = -0.0091$$

The variations of the rolling and yawing velocities with time then are

$$p = -0.0091 e^{-0.86t} + 0.1091 e^{-8.44t}$$

$$r = -.0407 e^{-0.86t} + .0407 e^{-8.44t}$$

$$\frac{dr}{dt} = +.035 e^{-0.86t} - .344 e^{-8.44t}$$

The terms of this equation that correspond to the large root decay at a very rapid rate. At the end of one-half of a time unit, these terms have one-one hundredth of their original value. Consequently, for the practical purposes, the relation between the yawing acceleration and the rolling velocity is given by the first terms.

An examination of these terms shows that the yawing acceleration will be opposite in direction to the rolling velocity, i.e., the wing that is rolling down will move forward. This is the condition that produces sideslip toward the low wing, and consequently the rolling moment acting to produce motion will be the difference of the rolling moments due to sideslip and yawing velocities.

Low Speed Flight

Case II

$\alpha = 16°$ $\quad np = 2.00$ $\quad nr = -0.9$
$C_L = 1.5$ $\quad lp = -4.86$ $\quad lr = +0.2$

$$D = -\frac{4.86 + 0.9}{2} \pm \sqrt{\left(\frac{4.86 + 0.9}{2}\right)^2 - (4.86 \times 0.9 - 2 \times 0.2)}$$

$$D = 2.88 \pm 4.93 = 2.05, \quad -7.81$$

$a_1 = 2.05$, $\quad a_2 = -7.81$

$$K_1 = \frac{2.05 + 4.86}{10.2} = 0.676$$

$$K_2 = \frac{2}{-7.81 - 0.9} = -.329$$

$$p = C_1 e^{2.05t} + C_2 e^{-7.81t}$$

$$r = 0.676 C_1 e^{2.05t} - 0.329 C_2 e^{-7.81t}$$

If the same rolling disturbance of 0.1 radian per unit of time is applied to the motion at this angle of attack, the constants C_1 and C_2 become

$$\begin{aligned} 0.1 &= C_1 + C_2 \\ 0 &= 0.676 C_1 - 0.329 C_2 \end{aligned}$$

$$C_1 = 0.486 C_2$$

$$C_1 = .0329 \quad C_2 = .0671$$

The corresponding variations of the rolling and yawing motions with time are

$$p = .0329\,e^{2.05t} + .0671\,e^{-7.81t}$$

$$r = .0222\,e^{2.05t} - .0222\,e^{-7.81t}$$

$$\frac{dr}{dt} = .0456\,e^{2.05t} + 0.174\,e^{-7.81t}$$

That the rolling velocity and the yawing acceleration are in the same direction in this case is immediately apparent from the solution of the moment equations. However, the direction of the sideslip velocity depends upon whether the ratio of yawing acceleration to rolling velocity is greater or less than that obtained from the equilibrium of forces given by (2).

In both the force and moment equations the limiting value of the ratio of yawing acceleration to rolling velocity depends upon wing loading, lift coefficient, and air density. For the case of zero sideslip, the following relation must hold

$$\frac{g}{V} = \frac{\left(\frac{dr}{dt}/p\right)_M}{T} \qquad (10)$$

where $\left(\frac{dr}{dt}/p\right)_M$ is the ratio of yawing acceleration to rolling velocity obtained from the moment equations.

T is the time unit of the system given by (4).

Writing V in terms of wing loading, air density and lift coefficient, and substituting the value of T, (10) becomes

$$\frac{g}{\sqrt{\frac{W}{SC_L\frac{\rho}{2}}}} = \frac{\left(\frac{dr}{dt}/p\right)_M}{\frac{1}{g}\sqrt{\frac{WC_L}{S\frac{\rho}{2}}}}$$

From which

$$\left(\frac{dr}{dt}/p\right)_M = C_L \qquad (11)$$

When the non-dimensional ratio of yawing acceleration to rolling velocity is greater than the lift coefficient the sideslip velocity produced will be outward. In the present case that ratio obtained from the solution of the moment equations is 2.20 per unit of time at the beginning of the motion. Since this value is greater than 1.5, outward sideslip will be present and unless special precautions are taken, the motion will be very unstable.

To demonstrate that the damping of roll is not the factor that determines the type of lateral motion at high angles of attack, a further calculation is carried out. In this case the rolling moment due to rolling is assumed to have a large positive, or "unstable" value. To addition, to eliminate the effect of the yawing moment due to rolling, that moment is assumed to be equal to zero.

Low Speed Flight

Case III

$\alpha = 16°$ $\quad np = a$ $\quad nr = -0.9$
$C_L = 1.5$ $\quad lp = 5$ $\quad lr = 10.2$

$$D = +\frac{5 - 9}{2} \pm \sqrt{\left(\frac{5 - 9}{2}\right)^2 + 5 \times 0.9}$$

$$D = 2.05 \pm \sqrt{8.7} = 2.05 \pm 2.95$$

$D = 5$, $\quad -0.9$

$a_1 = 5$, $\quad a_2 = -0.9$

$$K_1 = \frac{5 - 5}{10.2} = 0, \qquad K_2 = \frac{-.9 - 5}{10.2} = -0.58$$

$$p = C_1 e^{5t} + C_2 e^{-.9t}$$

$$r = -.58 C_2 e^{-.9t}$$

$$\frac{dr}{dt} = .52 C_2 e^{-.9t}$$

If, as in the previous cases, the yawing velocity is taken equal to zero at the start of the motion, the constant C_1 will also be equal to zero. The motion then will be similar to that at angles of attack below the stall and, with proper design, a divergence may be avoided.

The calculations show that the moment component most likely to cause difficulty at high angles of attack is the yawing moment due to rolling. If it is impractical to avoid a change of sign of this moment at the stall, the undesirable effects caused by it can be eliminated by designing for a large value of the yawing moment due to sideslip.

★ ★ ★

Editorials

AVIATION • ESTABLISHED 1916
VOLUME 35 NUMBER 8

NATIONALIZED AERONAUTICS?

► At the moment France is in the throes of debating the question of national ownership of munitions. This is not unexpected in the face of the troubled state of affairs in Europe, plus a government with strong left-wing tendencies. Before going very far into the subject, however, the inevitable question popped up,—"When is a munition not a munition?"—particularly troublesome in the case of aviation. Readers will recall that President Roosevelt had the same difficulty when he issued his first munitions control ukase last fall, upon which we commented in our March editorial.

What happens in France will bear watching. We cannot dismiss trends of this sort by saying "It can't happen here." Stranger things than that have taken place in the last few years. Although, at the moment, the world is in a military phase of its history, we believe that the future development of the airplane as an instrument of peaceful commerce will far outrun its development as a military weapon. For that reason we believe that every such effort to tie the airplane inevitably to the military, as is implied in nationalization of production under a munitions control program, should be resisted to the last ditch.

If the above reasoning is too Utopian there is another and a more immediately practical angle. With things as they are, and for some years to come, we are going to need efficient military aircraft in quantity as an essential part of our defensive arm. Nationalizing the industry is scarcely the way to solve that problem. No government ownership (outside of a completely socialized state), can possibly hope to attain the maximum in technical progress. Certainly the results that have been achieved by our Naval Aircraft Factory program under the Vinson Bill have not been particularly encouraging. Only by free development in the hands of competing, privately owned factories can we be insured against obsolescence in ideas and in types. It would be inevitable under nationalization that the best brains of the industry would soon become so bound round with red tape that they would cease to find any interest in new ideas.

That there should be some sort of control over aircraft production through the processes of government, is fitting and proper. But that aircraft factories should be nationally owned and operated,—decidedly no.

A.T.C. CONTEST

ONE of the events of the Los Angeles races that will probably attract little public attention because it does not involve full throttle pylon turns, is the 1936 A.T.C. contest sponsored by the National Aeronautic Association. The industry, however, should give careful attention to the results, for they should be indicative of design trends in a market that is going to be of increasing importance in the next two years,—the airplane for the private owner. Open to C licensed aircraft with engines under 500 cu. in., it is designed to bring out those features which should appeal to the private owner. Few people of this class are interested in racing performance, but they are concerned with economy, comfort and safety, coupled with the ability to travel reasonable distances at reasonable speeds. Carefully worked-out formulas and a detailed point scoring systems have been developed by the A.T.C. Contest Committee and we are looking forward to the results. Events of this sort have been run off in Europe for a number of years and have contributed greatly to the development of satisfactory *avions de tourism*. We hope that the continued work of the A.T.C. Contest Committee will lead to similar results here.

CHARTER COOPERATION

Even the seasoned air traveler sometimes needs a stimulant for his confidence when skies grow dark, lightning flashes, or blizzards rage. If he telephones his local charter operator and is told that *maybe* they will get through sometime tomorrow *if* the field at destination is hard enough to land on, he will more than likely go by train. People who answer phones in operator's offices should know what they are talking about. Although the prospect is not interested primarily in details, a brief substantial recital of the true conditions of the proposed flight and a businesslike approach will do much to inspire confidence. But this alertness must not end when the receiver is hung up. The ground transportation must arrive at the time agreed. The ship must be warmed up and ready to leave when the car arrives at the airport.

All these considerations and many more are essential to the highest type of charter operation. All of them cost plenty of money. And there is a reasonably large group of people who can afford to pay the price.

There is also a place for the growing operator, who has not yet attained the highest degree of perfection in his service, whose organization and fleet are small but have been soundly developed and maintained. His prospects come naturally from a lower income bracket, and they cannot afford or are unwilling to pay the top price.

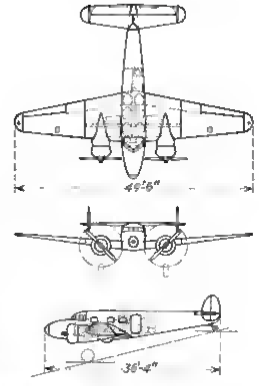
Alert operators from both classes know their respective limitations and it behooves them to be honest about them with their prospects and themselves. There is more to be gained by sacrificing a job to another operator than by attempting to give service without the necessary background organization or by giving the highest type of service to a prospect who does not want or need it.

Flying Equipment

What's new in aircraft, engines and major accessories

Latest Lockheed

The new Model 12, closely resembling the Electra, turns in high performance



WHEN we stopped in at Lockheed's Burbank (Calif.) plant in mid-July, we were somewhat disappointed to find that the first of the Lockheed 12's had already left the factory and was "on the road" following her A.T.C. test. Consoling, however, was the information that the ship was due to appear shortly on eastern airports. We were delighted, therefore, when the other day Courtland Gross of the New York office called us to let us know that the 12 was spending a few days at North Beach. Hopping into the trusty Chariot, we lost no time in getting out there to see her.

First seen, standing on the line, her antecedents were unmistakable. Although somewhat slimmer in line, about the nose and about the fuselage rear section, the Electra influence is marked. She gives a very distinct first impression of compact power and speed.

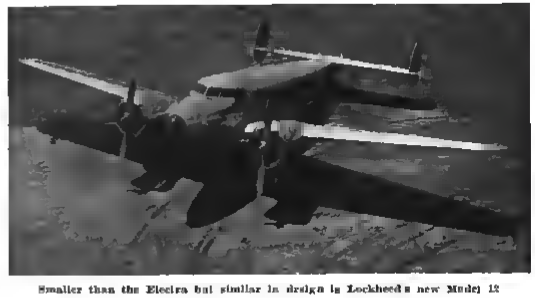
Nor does her performance belie her appearance as we found out a few minutes later in the air. With only four aboard, just half her capacity load, she got away like a frightened rabbit and seemed to climb away from the ground at a phenomenal rate. She handled easily and positively at both low and at high speeds. Full control was maintained and turns were made with apparent ease right and left with one engine throttled. Her two 450-hp Pratt & Whitney Wasp Juniors were fitted with constant r.p.m. Hamilton Standard controllables.

Landing, with flaps down, seemed normal enough and, with full application of the brakes, the ship came to a stop with a very short ground run.

Although the ship is normally designed to carry six passengers and two pilots, all in single chairs facing forward, No. 1 job has a comfortable divan along the starboard side, (in place of seats) and the forward passenger seat on the port side has been replaced with a small icebox. The after port seats now face each other. The interior, however, lends itself well to a wide range of treatment depending upon the desires of the customer.

From a comfort standpoint, the ventilation seemed quite adequate. In the air, the ship was cool and comfortable in spite of the fact that on the ground New York was experiencing one of the hottest days of the summer. The noise level seemed satisfactory for a ship of this type. The cockpit is not particularly quiet, but with the connecting door closed, the cabin noise level seems to be about the same as the modern airline.

Head on, the reason for the Model 12 high performance is apparent



Smaller than the Electra but similar in design is Lockheed's new Model 12

The flap and flap operating mechanism. Note how the ailerons are rigged to droop simultaneously with the operation of the flap

One of the accompanying pictures shows how the flaps are built, hinged and operated. They are electric-motor-driven.

The landing gear is mechanically retractable with high speed electrical operating mechanisms. An auxiliary hand driven mechanism is also available for emergency use. Brakes are hydraulic. Aerol shock struts are standard equipment. A choice of wheel and tire equipment is offered: (*a*) Hayes streamlined 31 in. with General eight-ply with 31-in. streamlined tires; (*b*) Hayes 11.00x12 wheels with Goodrich eight-ply 11.00x12 tires, or (*c*) Goodyear 30x13-6 wheels with Goodyear heavy duty tires. The tail wheel is a Bendix 13.25 stream-lined type with Goodyear streamlined type.

Cabin and cockpit heating and ventilating systems are manually controlled. The latter has individual control for each passenger.

The two Wasp Jrs. are mounted on steel tube supports on Lord rubber bushings. Fuel is carried in four tanks in the wings between the nacelles and the fuselage. The total capacity is 195 gal. Tanks are fitted with dump valves. Engine oil is carried in two tanks of 7-gal. capacity each.

Both engines are fitted with the American La France Alfite CO_2 fire extinguisher system. A Pyrene hand-type is also furnished for the cabin.

The instrument board layout is clean-cut. Equipment consits of Pioneer compass, altimeter, air speed indicator, rate of climb indicator, bank and turn indicator, manifold pressure gages, fuel and oil pressure gages, and clock. Weston electrical oil temperature indicators, electrical tachometers, engine head temperature indicators, outside air temperature indicator, and carburetor air temperature indicator are standard equipment. Moto Meter supply fuel quantity gages. A Cambridge exhaust gas analyzer was noted on the board. Position indicators for flap and landing gear were worked out by Lockheed.

Interior of Lockheed 12 fuselage during construction

Although two-way radio equipment is not standard, provision is made for the Western Electric type. Primary power supply for all electrical equipment is an Exide Type 6-TS-13-1 storage battery of 38 amp. capacity. A full set of navigating and cabin lights is included. Two Type FP-250 Grimes retracting landing lights are set flush in the lower surfaces of the wings. Cannon quick detachable multiple plugs are used to carry the electrical circuits through the fire walls.

Starting and electrical equipment for the engines is by Eclipse. Pesco engine fuel pumps are fitted with a National Steel product Type D2 hand emergency pump available. Two 6-in. United Aircraft Products oil radiators with thermostatic control are fitted. The exhaust stacks and collector rings are by Solar of San Diego.

The Lockheed 12 carries approved type certificate No. 618. The general specifications follow: Length, 36 ft. 4 in.; span, 49 ft. 6 in.; height overall (tail on ground), 9 ft. 9 in.; wing area (including ailerons and fuselage) 352.0 sq. ft.; landing gear tread, 13 ft. 6 in.; total volume of passenger cabin (incl. pilot compartment, 285 cu.ft.; nose baggage compartment volume, 28 cu.ft., rear baggage compartment volume, 36 cu.ft., maximum width inside of cabin 60 in.; maximum height inside of cabin — floor to roof, 60 in.; maximum length inside of cabin, 14 ft. 8 in., take-off run at sea level (with 400 hp. rating) 825 ft., take off time at sea level (with 400 hp. rating), 11 seconds; maximum rate of climb at sea level, (wheels up), 1,470 ft./min., landing speed at sea level (wing flaps down), 65 m.p.h.; fuel consumption with 300 hp. (.52 lb./hp./hr.) 52 gal./hr.; cruising range with 300 hp. (200 gal.), 780 miles; fuel consumption with 260 hp. (200 gal.) 900 miles; service ceiling (both engines), 23,350 ft.; absolute ceiling (both engines), 25,100 ft.; absolute ceiling with full load and one engine, 9,500 ft.; absolute ceiling with half fuel dumped and one engine, 10,800 ft.; maximum speed at sea level, 214 m.p.h.; maximum speed at 5,000 ft. with 400 hp., 226 m.p.h.; cruising speed at sea level with 300 hp. 192 m.p.h., cruising speed at 5,000 ft. with 300 hp. 203 m.p.h.; cruising speed at 9,800 ft. with 300 hp. 213 m.p.h.; cruising speed at sea level with 260 hp. 181 m.p.h., cruising speed at 5,000 ft. with 260 hp. 191 m.p.h., cruising speed at 12,000 ft. with 260 hp. 204 m.p.h.

450 hp. may be used on the take-off only with the constant speed propeller. Take-off distance is 710 ft. (217 meters) for this power.

Gross weight of the Model 12 is 8,400 lb.; empty weight (with standard equipment, and also including complete Western Electric two-way radio) 5,765 lb.; useful load, 2,635 lb.; passengers (six), 1,020 lb.; pilots (two), 340 lb., cargo (mail, baggage, express, etc.) 450 lb., maximum oil capacity, (14 gal.) 105 lb., Normal fuel capacity (120 gal.) 720 lb., maximum fuel capacity (200 gal.), 1,200 lb.; wing loading, 23.9 lb./sq.ft., power loading, 10.50 lb./hp.

All speeds of the plane, guaranteed within 3 per cent, all ceilings guaranteed within 5 per cent, all take off runs, take-off times, and rate of climbs, guaranteed within 5 per cent; all weights guaranteed within 3 per cent, the engine fuel consumption is that stated by the engine manufacturer, the cruising range is based on the engine manufacturer's stated fuel consumption, single engine performance based on equivalent climbing altitude and not density altitude.

Landing gear and nacelle details

Pilot compartment of the Lockheed 12

Bloctube Controls

Tampier system to be introduced to the American market

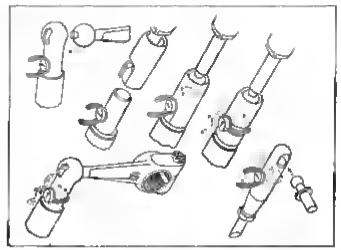
The Tampier "Bloctube Control" system, which has been used on several recent European planes, is shortly to be introduced in America. Inventor Rene Tampier was formerly engaged in the manufacture of airplanes at Boulogne-sur-Seine, near Paris. He is planning an early visit to this country. M. Tampier will be remembered as the inventor of a plane that could be driven along the roads like a motor car.

The Tampier system consists essentially of control tubes and ball joints designed to provide positive control and eliminate play and to simplify maintenance. Two types of joint, the "ball lever" and "ball tube" are used. The ball lever consists of a socket in which a spherical thrust block, backed by a spring, bears against a ball. Spring tension is controlled by a key which forms a cam and which can be locked in the tension position (adjusted at the factory) by a "U" shaped clip turned downward around the socket. No tools are needed to lock or unlock the joint.

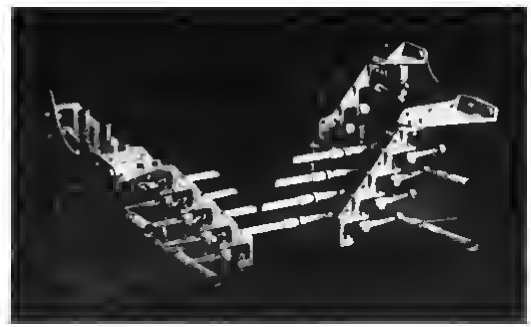
The ball tube joint is mounted on the hand levers or between two tubes whose angularity is very slight. Slack is taken up in the same manner as in the ball lever joint. The key, however, has two grooves one of which enters a bayonet slot in the sleeve. Disconnection is accomplished as readily as in the case of the ball lever joint. Weight is about ½ oz.

Control levers and their balls are stamped from one piece of raw material and are surmounted by a nipple or center pin to limit the angular motion of the joints. When they are joined, an internal set of teeth allows for the angular variation of less than 4 deg. of each lever with the transmission. Lever bearings are spring loaded and pressure lubrication is used. Weight of the bell crank lever without joint is about 1 oz. and that of a simple bearing is about ½ oz.

Countershaft levers are used to group these transmissions as closely together as possible in multiple installations. A safety device is installed to be used if a control member jams. Variations of the system for every possible requirement in modern air transport design are available.



How the joints are connected and disconnected



A typical multiple control installation

Propeller Governor

Construction details of Hamilton-Standard's constant speed propeller control finally disclosed

ALMOST two years ago, we had our first opportunity to fly behind Hamilton-Standard's automatic propeller control At that time (AVIATION, Dec, 1934, p. 409) we told in some detail how the thing worked We used the word "uncanny" to describe its behavior and, although we have seen a good many of them operating in service, since that time, we still think the description applies.

Until recently, however, the whole equipment was rendered more mysterious because Hamilton-Standard had felt it necessary to withhold the details of how it was made and what went on inside the housing when it was at work. Now, however, we have received a complete description of the gadget from our good friend, Joe Lowes up at East Hartford, which completely dispels all mystery.

The primary function of any constant speed propeller is to permit the engine to run at desired r p m. regardless of altitude or forward speed of the airplane This is important not for propeller performance but for engine operation, since power depends on both the r.p.m. and the throttle opening. The constant speed propeller makes possible the control of engine speed independent of the throttle. From one standpoint it acts as a governor holding r p m. constant no matter whether climbing, diving or flying level From another standpoint it acts as a controllable load, permitting the engine to develop as much of its full rated power as the pilot wishes

This is accomplished by automatic change of propeller pitch. In the Hamilton Standard design the pitch is shifted by oil pressure, the propeller itself being basically the same as the Hamilton Standard two-position controllable Counterweights acted on by centrifugal force provide the operating force to move the blades toward high pitch, and the oil pressure works in the opposite direction against the counterweights, setting the pitch to any intermediate position between full low and full high.

Pitch is automatically selected by a separate unit called the Constant Speed Control which regulates the oil pressure in the propeller operating cylinder. A simple gear pump in this unit boosts the engine oil pressure up to 180-200 lb. per sq. in. where it is maintained by means of a relief valve. Although considerably less pressure is normally required to shift pitch, this comparatively high value is desirable to give responsive pitch changing action when called for by the constant speed control. It provides better governing and eliminates over-reviving and under-reviving which might result from sluggish action.

Figure 1 indicates propeller, constant speed control, and booster pump in their associated relation for three different operating conditions. The first, "Underspeed," is the case where r p m is less than that desired, such as occurs momentarily when the airplane is pulled up into a climb, or when the throttle is moved to a partially closed position The second, "Overspeed," is the case where r p.m. is more than that desired, such as occurs momentarily when the plane is nosed down into a dive, or when the throttle is opened rapidly In the third case "On Speed," the r p.m. is exactly the amount for which the control is set and there is no need to increase or decrease the propeller pitch when these conditions obtain.

In the speed control a pilot valve moves up and down in a cylinder in response to the action of fly weights working against the tension of a spring referred to as the "r.p.m. spring." The weights are driven by the engine in proportion to engine speed; the tension of the spring is controlled by the pilot. Obviously the greater this spring tension is, the faster the fly balls must rotate before they can compress the spring upward. When they are not rotating fast enough to accomplish this the spring forces the pilot valve downward so that it uncovers the port leading to the propeller feed line as shown in the "Underspeed" sketch This allows oil under pressure from the booster pump to flow to the propeller decreasing its pitch. When the fly balls are rotating faster than the speed for which the spring tension is set, they compress the spring, carrying the pilot valve upward opening the propeller port and allowing the oil in the propeller cylinder to drain back to the engine. This shifts the propeller toward high pitch as shown in the "Overspeed" sketch. The "On Speed" condition results when the rotation of the fly balls is just sufficient to balance the spring tension and hold the pilot valve so that it closes the propeller port Under these conditions the pitch remains constant. This is the stabilized condition in which the pitch is exactly right to give the desired r p m

The booster pump is a simple gear type driven by the engine. Oil from the engine pressure system feeds into it and is boosted to higher pressure. This high pressure oil fills the space between the necked-down section of the pilot valve and the walls of the cylinder, and backs up against the spring-loaded relief valve When the pressure builds up to about 180 lb per sq.in. the relief valve opens allowing some of the oil to circulate around the pump and come back into it again on the low pressure side, the same oil being used over and over without drawing on the engine lubricating supply Only when the pilot valve moves downward as shown in the "Underspeed" sketch does any of the oil flow out to the propeller, and in this case only is there a demand for more oil from the engine supply. At all other times, "Overspeed" and "On Speed," the relief valve stays open relieving enough of the pressure to maintain 180-200 lb per sq.in. available for use

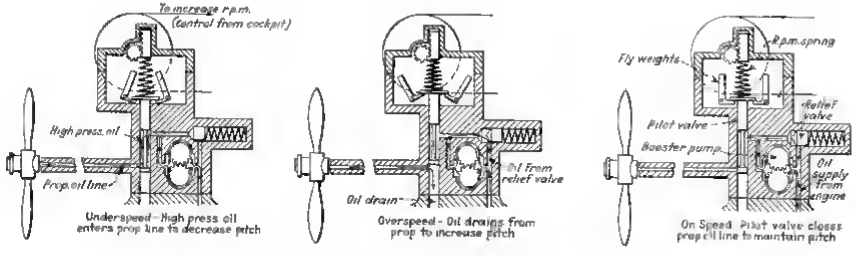


Fig 1—Relative positions of propeller, constant speed control, and booster pump for three operating conditions

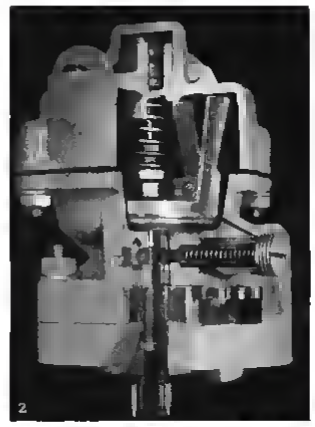


Fig 2 (left)—Cutaway view of the constant speed control unit
Fig 3 (right)—Mounting of control unit on nose section of engine

Figures 2 and 3 are photographs of cut-away units Fig 2 is the standard constant speed control and Fig 3 shows it mounted on the nose section of an engine with the propeller installed on the engine shaft. This gives a clear idea of the oil passage leading from the engine pressure supply to the booster pump and of the feeder line from the pilot valve to the propeller In the feeder line the oil flows in both directions, to the propeller when decreasing pitch and from the propeller when increasing it.

The drawing, Fig 3 shows the method of transferring oil from the feeder line into the rotating engine shaft, thence to the propeller A set of rings, called "transfer rings" ride in annular grooves around the shaft and in the engine case, allowing oil from the feeder line to flow into the hollow shaft and vice versa, and at the same time sealing it from leaking out into the engine In Fig 1 these transfer rings are not indicated, but all principal parts are included and it is easy to visualize what goes on in the actual unit by cross-reference to the schematic sketches

All Hamilton-Standard controllables can be converted readily into constant speed propellers by the installation of a constant speed control on the engine and by conversion of the propeller to greater pitch range, if necessary. In some cases other minor parts have to be changed, but in every instance the conversion can be accomplished as a field modification

Operating characteristics of constant speed propellers require a departure from the conventional method of manual mixture adjustment. Any increase or decrease of power obtained by adjusting the carbureter fuel/air ratio is accompanied by a change of propeller pitch such that the r p.m. is not affected. Tachometer indications, therefore, cannot be depended on as with fixed pitch propellers, and instead it is customary to use automatic mixture controls or fuel/air ratio indicators, such as exhaust gas analyzers and fuel flow meters

Provision is made so that the pilot can discontinue the governing action whenever desired and shift the propeller into full high pitch, but except for checking the pitch-changing action or the engine operation there is no point in discontinuing the governing action with power on. However, positive high pitch does have one very important use, namely in case of engine failure on a multi-engine airplane, wherein the performance of the plane with one engine out can be materially improved by shifting the dead engine's propeller to full high pitch where its windmilling drag is much less than in low pitch. Without this feature the dead engine's propeller would automatically be shifted to the full low pitch position by the constant speed control trying to maintain r p m

New Link Trainer

Chief improvement is an automatic course recorder

THE NEW Link Advanced Trainer, recently placed on the market, not only reproduces all conditions of instrument flying but embodies an automatic course recorder, electrically operated by the trainer controls which traces the course "flown" by the student with absolute accuracy, even including slight turns and minute errors in compass headings The instructor has no control over the recorder, and the student cannot reach the cone of silence of the range beacon unless he actually has the skill to do so

Outwardly, the trainer remains unchanged, having the same foreshortened fuselage and wings, mounted on a turntable operated pneumatically by bellows actuated by the trainer controls. However, in addition to the four basic instruments of the old trainers, namely turn-and-bank indicator, air speed meter, rate of climb, and magnetic compass, the new trainer also has a sensitive altimeter, directional gyro, artificial horizon, radio compass, radio marker beacon indicator, and a throttle. The use of these instruments permits simulating every flight condition met in actual instrument flying

For example, the student makes his "take-off" by operating the throttle and the proper controls of the trainer As the throttle is advanced the air turbine is started and regulated by the throttle the air speed reading increases, and the rate of climb indicator and the altimeter respond in accordance with the attitude of the trainer The student

AT 300 MILES

At all speeds . . these oils give you *positive protection*

HERE is an airplane lubricant that meets the most grueling requirements of high temperatures in any engine built today.

Yet, it is free flowing and gives positive lubrication, even at the lowest temperatures.

Such performance was not possible until Texaco refining engineers developed a special process for making oils.

This process eliminates the harmful impurities and assures a product that is *all lubricant*—free from harmful carbon and sludge forming elements.

These lubricants were not developed specifically for any one type of service. They were made to cover the entire range of airplane requirements and will maintain constant power no matter what type of activity you are engaged in—private flying—commercial operations . . endurance and altitude tests—and speed.

That is why three out of four leading transport operators, after testing well-known airplane oils on the market, have standardized on Texaco Products for their equipment.

A Texaco aviation representative will be glad to provide practical engineering service to prove the economies of Texaco Products.

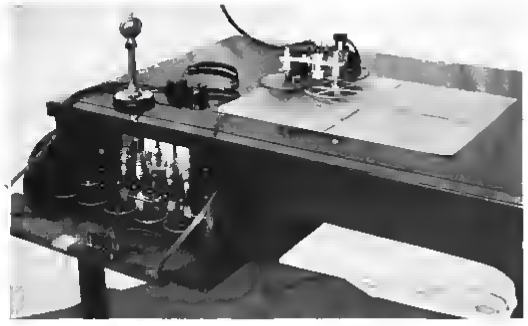
THE TEXAS COMPANY

135 East 42nd Street · New York City

Nation-wide distribution facilities assure prompt delivery

TEXACO

Aviation Products



Details of the 'flight' are recorded by this device.

The instrument board is more complicated

"climbs" to a safe altitude, and proceeds to his destination guided by radio signals from the instructor's station. An automatic spinning device is now also provided with the trainer, causing it to spin if the trainer is stalled. The recover from spin in the trainer is the same as in a real airplane.

The radio equipment of the new trainer provides two-way radiophone communication, key transmission for code practice, choice of five different radio stations, two marker beacons, radio compass control, and amplifying system. With this equipment, the student is enabled to tackle any problem of radio navigation over a network of several radio range beacons, maintain two-way communication by voice or code, and check his position by marker beacons and the radio compass, or maintain a radio compass course to his destination.

The automatic recording device shown in the photograph, runs on three wheels geared to a single synchronous motor, operated by another motor located underneath the trainer base. When the trainer turns, the motor underneath its base is also turned transmitting an electrical impulse to the recording device, causing it to turn correspondingly. There is no mechanical connection between the trainer and the recorder. The forward motion of the recording device is obtained from two of its wheels driven by two constant speed electric motors. The third wheel is equipped with a tracing pen, supplied with ink from a rotary inking pad. The instructor's "radio station" with its controls, microphone and earphones is seen in the compartment on the left side of the desk.

RCA Radio Compass

New device combines aircraft receiver and homing radio

A combination of an aircraft receiver and a homing radio compass is embodied in the new Model AVR-8 unit recently introduced by RCA. The receiver section is of the three-band type and may be used for reception of weather, radio range, entertainment broadcasts, and high frequency communication. By tripping a switch and adjusting the visual indicator the set may be transformed into a navigating radio compass. Two frequency bands are provided for radio compass work (200-410 kilocycle radio beacon weather band and 550—1500 kilocycle standard entertainment band). Thus the course is not confined to the narrow path of the radio range beacon but the pilot can approach the beacon station directly from any point outside the path. The intermediate frequency band (550 to 1600 kilocycles) is used when radio broadcast stations constitute the homing objective.

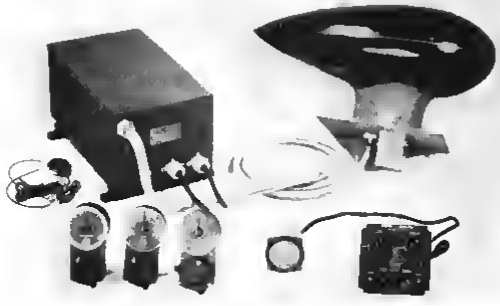
Not only does the AVR-8 make it possible to fly directly toward a broadcasting station but it is helpful in flying away from one to a point where there is no station by utilizing the reciprocal bearing arrangement which is a feature of the design. In two of the four available models, rotatable loops are supplied which enable the pilot to determine the plane's position by means of cross bearings. Both fixed and rotatable loops are enclosed in low drag streamlined housings, when installation cannot be made inside of the airplane.

Simultaneous reception of visual and aural signals is possible by the use of the visual radio compass indicator. This feature is particularly valuable when approaching a radio beacon station above the ceiling, because weather broadcasts may be tuned in while the visual indicator is being used and the danger of passing over the station while listening to the weather broadcasts is eliminated. The simultaneous feature also permits the use of broadcast signals for entertainment when flying a course to or from the stations and provides a continuous check on the station call letters. Aural and visual output control are entirely independent and when flying a visual course the audio volume control may be set at a minimum without any effect on the visual indicator.

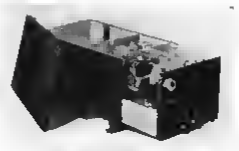
The receiver unit uses a ten-tube superheterodyne circuit and the radio frequency portion follows the fundamental design of other RCA sets while the intermediate frequency transformers are of the latest iron core type. With the combined compass unit it is mounted on a single chassis contained in a rugged metal case shock mounted to the aircraft. Finger-operated suitcase type fasteners are used to retain the chassis in the case by clamping down the lid. The chassis is readily accessible for inspection or repair.

Both fixed and rotatable loops have the same electrical characteristics. The rotatable loop is connected through a 96 in. tranmission line to an azimuth control head which with the band change and tuning control heads may be mounted separately or grouped on a single panel as desired. Band switching is done at the loop base and controlled through a mechanical drive cable.

Weights of the various units are as follows: Receiver-compass unit, 30½ lb.; Fixed loop, 11½ lb.; Rotatable loop, 11½ lb.; Loop cable (electrical), 1½ lb.; Small panel including electric cables 3½ lb.; large panel including electric cables and 2 mechanical control heads, 8½ lb.; Mechanical control heads only, 1 3/5 lb.; 15 ft mechanical cable for tuning and receiver band change, 1½ lb.; 23 ft mechanical cable for loop rotating and band switching, 2¾ lb.; Left-right indicator, 1½ lb.; Head phones, ½ lb.



Component parts of the Model AVR-'A radio compass



How the chassis comes out of its case

The visual indicator dial

C-W Basic Trainer

Model 19-R may be used as fighter or attack plane

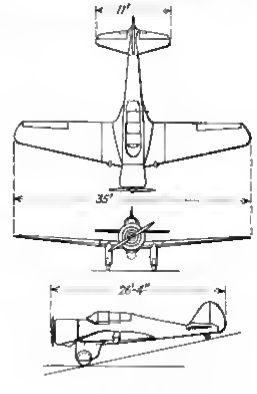
The Model 19-R basic trainer by Curtiss-Wright has recently been completed and test flown. The new ship becomes a two-seat fighter by the installation of a fixed machine-gun synchronized with the motor, a flexible machine-gun, and bomb racks. Conversion into an attack plane is effected by installing a fixed gun in each landing gear compartment. Provision is made for the installation of any Wright-Whirlwind engine ranging from 250 to 420 hp.

Curtiss-Wright Model 19-R Basic Trainer

The Model 19-R is of cantilever stressed skin design and resembles the large transport planes in aerodynamic and structural features. The fuselage is of semi-monocoque construction, consisting of Alclad skin, longitudinal stringers and transverse bulkheads and rings. The forward bulkhead which constitutes the fire-wall consists of two metal sheets with asbestos between them.

Most important departure from the commercial design is found in the enclosure which is a transparent coupe top covering the tandem cockpits. Two sliding sections of the enclosure telescope into a fixed central portion which is also transparent. Adjustment of the sliding members to several positions provides varying degrees of ventilation. The wing is of the high-lift type, tapered in plan form and thickness and employing an airfoil section especially developed by Curtiss-Wright. The wing structure is multi-cellular and is built up of five shear beams with ribs spaced along the span at 20 in. intervals. Ribs and beams are designed to carry only the shear loads, while the skin and its reinforcing stringers carry the compression and tension loads. 24 ST Alclad is used throughout.

The flaps are of the split trailing edge type extending over 55 per cent of the span. Their use reduces the gliding and landing speeds more than 10 m.p.h. The all-metal stressed skin ailerons are dynamically and statically balanced.



The wing is attached to the fuselage through a riveted channel on the fillet and a riveted attachment of each bulkhead to the wing skin proper. The attachment of the wing panels is accomplished by a splice located just outboard of the landing gear.

Similar in construction to the wing are the horizontal and vertical tail surfaces. Fin and stabilizer are integral with the

PERFORMANCE AND WEIGHTS OF THE CURTISS WRIGHT BASIC TRAINERS

Engine	Wright Whirlwind R975-E2		Wright Whirlwind R760-E2	
	As Trainer	Incl. Armament	As Trainer	Incl Armament
High Speed (m p.h.)	215	208	193	182
Cruising Speed (m.p.h.)	201	190	180	169
Stalling Speed (m.p.h.)	54	58	53	57
Rate of Climb (ft/min)	2080	1750	1370	1370
Range Full Throttle (miles	430	406	483	406
Cruising Range (miles)	602	570	739	710
Service Ceiling (feet)	25000	20000	23000	19000
Absolute Ceiling (feet)	26000	22500	25000	21500
Wing Loading (lb/sq ft)	15 4	18 4	14 8	18 4
Power loading (lb/h hp)	6 4	7 6	7 6	10
Weights				
Gross Weight (lbs)	2692	3200	2o31	3200
Weight Empty	1827		1666	
Useful Load				
Crew 2@ 200	400		400	
Fuel 70 gal	420		420	
Oil 8 gal	45		45	
Total normal useful load	865		865	
Normal Gross		2692		2531
Design Gross		3200		3200
Extra Useful load for Armament		508		669

fuselage, all loads being carried through the skin and stiffener assembly. The tail wheel unit consists of an 8-in. streamline wheel and tire mounted on a single-sided fork of the most recent military type. Its oleo strut has a 3-in travel and is equipped with a taxiing spring. Although the unit is steerable for control of taxiing, it is fitted with an automatic release which leaves the wheel free to caster through 360 deg for hangar handling.

Landing gear is of the fixed cantilever type. Wheels are enclosed in the fairings in flight and dropped automatically to landing position when the flap is lowered. Eight inches of oleo motion are provided and a rubber block in the strut is used in taxiing. Standard equipment includes hydraulic brakes with parking control in the front cockpit.

No change in the engine mount is required for installation of any of the seven or nine-cylinder Whirlwinds in the 250 and 420-hp range. Slight modifications in the cowling, however, are necessary for some of the models. Two 35 gal wing tanks provide the necessary fuel capacity and a reserve stand pipe is installed in the left tank so that 10 gal remain after the main supply of gasoline has been exhausted. Sight fuel gages are installed in the upper surface of each tank and are visible from the cockpit. The oil tank in the engine compartment has a capacity of 6½ gal with a 1-gal expansion space.

Armament includes a fixed 30 caliber machine-gun forward of the firewall and synchronized to fire through the propeller. A cartridge case is provided for 500 rounds of ammunition. Mounting supports are installed for a gunsight to be attached to the fuselage and cowl bracket just forward of the windshield. In the rear cockpit a flexible mounted 30 caliber gun may be installed on a retractable mount. The support is a swivel carriage which permits a wide range of firing angles. Bombing equipment includes provision for two standard A-3 bomb racks.

In the forward cockpit, from which the plane is designed to be flown, is instrument equipment including air speed indicator, tachometer, altimeter, engine gage unit, bank and turn indicator, rate of climb indicator, compass and clock. Only the air speed indicator, tachometer, altimeter and engine gage unit are normally duplicated in the rear cockpit. Seaplane floats are interchangeable with the main landing gear units.

General dimensions are: length overall, 25 ft.; wing span, 35 ft.; height 7 ft. 6 in.

Vought Fighter

Model V-143 developed for Army Air Corps from original design by Northrop

DEVELOPED from original designs of Northrop and constructed in the Chance-Vought factory, the Model V-143 was recently test flown at Rentschler Field and delivered to the Air Corps Material Division at Dayton. Although the tests were made with the fourteen-cylinder 750 hp. Twin Wasp Junior, an alternative power plant installation is the new nine-cylinder Wasp Junior developing 600 hp for take-off and 525 hp at critical altitude.

The airplane structure is metal throughout with sheet metal covering excepting the control surfaces which are covered with fabric. Load factors are sufficient to permit of acrobatic maneuvers and terminal velocity dives and the ship meets all of the Air Corps specifications for a pursuit or fighter type airplane.

Contributing to the performance are retractable landing gear and wing flaps. Cowl flaps are used for controlling the engine cooling. Normal equipment includes the Hamilton-Standard controllable propeller but still higher performance can be obtained by the installation of the constant speed propeller. The pilot's cockpit is located far forward to provide unrestricted vision and a sliding enclosure of transparent material covers the cockpit in flight.

Normal armament includes two 30 caliber machine-guns mounted in the fuselage and synchronized to fire through the propeller disc, with 500 rounds of ammunition for each gun. Two 50 caliber guns with 200 rounds of ammunition each may be substituted if desired. For bombing, the equipment includes two external bomb racks mounted under the wings. A maximum of 300 lb. of bombs are carried in this type of service.

General dimensions and performance include the following: over-all span, 33 ft. 6 in.; gross weight, 4,060 lb., maximum speed (8,000 ft.), 250 m.p.h.; cruising speed (8,000 ft., 75 per cent power), 220 m.p.h.; cruising speed (8,000 ft., 50 per cent power), 186 m.p.h.; landing speed with landing load, 60 m.p.h.; rate of climb at 8,000 ft., 2,100 ft./min.; service ceiling, 28,000 ft.; cruising range (8,000 ft., 75 per cent power), 770 miles; cruising range (8,000 ft., 50 per cent power), 1,070 miles.

The Vought V-143

Improved Performance for NA-16

North American Aviation announces a new model, also improved performances for older series

In the July, 1936 issue of AVIATION (p. 38) we described a general purpose military ship now being produced by North American Aviation, Inc., at its Inglewood, Calif., factory. Since publishing the specifications for the ship at that time, certain revisions have been made and the power on the Model NA-16-5 has been considerably stepped up.

The structural features of the ship remain as described in the July issue. The specification table given below, however, has been brought up-to-date. Since this ship is available for export, the specifications have been given in both English and in metric systems.

With slight alterations, the Basic Trainer may easily be converted into a fighting ship for fixed machine-gun fittings have been developed whereby either one or two synchronized guns may be installed, as each is a separate unit. The mounts are made as part of the fuselage structure with removable ammunition boxes. A flexible machine gun may be installed in the rear cockpit, the mount being of the track type.

General aviation's NA-16 series, the latest specifications for which are given below.

PERFORMANCE CHARACTERISTICS

Type	NA-16-1 General Purpose Two-Place	NA-16-2 Fighter Two-Place	NA-16-3 Bomber Two-Place	NA-16-4 Advanced Trainer Two-Place	NA-16-5 Fighter Single Place
Engine	P & W Wasp S3H1	P & W Wasp S3E1	P & W Wasp S3H1	Wright R-975-E2	Wright SR-1820 G-37
Power/Altitude	550/5000 (1636M)	500/11000 (3352M)	500/11000 (3352M)	440/0	825/4000 (1220M)
Propeller	Two-Position Controllable	Two-Position Controllable	Two-Position Controllable	Fixed Pitch	Two-Position Controllable
HIGH SPEED					
Fixed Landing Gear m.p.h./ft.	210/5000 (338Km/1522M)	216/11000 (344Km/3352M)	216/11000 (341Km/3352M)	183/0 (301Km/0)	250/7000 (416Km/2133M)
Retractable Landing Gear m.p.h./	018 5000 (341Km/1525M)	224/11000 (361Km/3352M)	220/11000 (354Km/3352M)	195/0 (314km/0)	270/7000 (435Km/2133M)
CRUISING SPEED—75% Power					
Fixed Landing Gear m.p.h./ft.	202/12000 (325Km/3660M)	210/13000 (338Km/3965M)	205/13000 (330Km/3965M)	173/9000 (287Km/3430M)	252/15000 (406Km/4571M)
Retractable Landing Gear m.p.h./ft.	012/12000 (341Km/3660M)	218/13000 (351Km/3965M)	216/13000 (347km/3965M)	186/9000 (299Km/3430M)	260/15000 (419Km/4571M)
CRUISING SPEED—62.5% Power					
Fixed Landing Gear m.p.h./ft.	193/10000 (310Km/4876M)	200/22000 (322Km/6710M)	193/22000 (311Km/6710M)	172/13000 (277Km/3965M)	236/20000 (380Km/6100M)
Retractable Landing Gear m.p.h./ft.	200/10000 (330Km/4877M)	205/22000 (335Km/6710M)	200/22000 (322Km/6710M)	180/13000 (289Km/3660M)	244/20000 (393Km/6100M
MAXIMUM RATE CLIMB—ft./min.	1,800 (548 M/mnt	1,670 (509 M/mnt)	1,670 (473 M/mnt)	1,350 (410 M/mnt)	3,363 (998 M/m/n)
ABSOLUTE CEILING—ft.	27,300 (8 320 M)	30 200 (9 755 M)	29 200 (8 870 M)	25 400 (8 050 M)	28 000 (8 448 M)
SERVICE CEILING—ft.	26 000 (7,900 M)	28 000 (8 535 M)	28 000 (8 349 M)	24 000 (7 320 M)	26 800 (8 178 M)
LANDING SPEED—m.p.h.	65 (105 Km/Hr)	65 (105 Km/Hr)	65 (105 Km/Hr)	60 (96 Km/Hr)	66 (106 Km/Hr)
CLIMB TO 10,000 FT (min.)	6 4	7 6	7 6	10 0	3 3
TAKE-OFF RUN—SEA LEVEL—ft.	435 (133 M)	400 (122 M)	420 (128 M)	580 (171 M)	280 (85 M)
CRUISING RANGE (62.5% Power) miles	665 (1,070 Km)	765 (1 232 Km)	738 (1,185 Km)	990 (1,594 km)	610 (982 Km)
CRUISING RANGE (Econ Speed) miles	820 (1,320 Km)	960 (1,545 Km)	900 (1,450 Km)	960 (1,453 Km)	700 (1 127 Km)
PERFORMANCE BASED ON GROSS WEIGHT (lb.)	4,500 (2,040 Kg)	4,500 (2,040 Kg)	4,580 (2,180 Kg)	6,450 (1 760 kg)	4,450 (2,070 Kg)

GENERAL SPECIFICATIONS

GENERAL DIMENSIONS					
Overall Span	42' 0" (12 8 M)	42' 0" (12 8 M)	40' 0" (14 05 M)	42' 0" (13 8 31)	36' 0" (10 97 M)
Overall Length	27' 6" (8 32 M)	27' 4" (8 32 M)	27' 4" (8 32 M)	27' 454" (8 34 M)	27' 4" (8 32 M)
Overall Height	8' 8" (2 64 M)	8' 8" (2 64 M)	8' 8" (2 64 M)	8' 8" (2 64 M)	8' 8" (2 64 M)
WEIGHTS					
Gross—Full Load (lb.)	4,500 (2,040 Kg)	4 805 (2,040 Kg)	5 805 (2,440 kg)	3 880 (1 750 kg)	4 550 (2,070 Kg)
Normal Useful Load	1 355 (614 Kg)	1,330 (607 Kg)	2 161 (952 Kg)	1 055 (466 Kg)	1 110 (505 Kg)
Empty	3 145 (1,426 Kg)	3,101 (1 433 Kg)	3,199 (1 450 Kg)	2 825 (1 282 Kg)	3,440 (1 560 Kg)
NORMAL USEFUL LOAD					
Fuel, 108 Gal. (lb.)	624 (283 Kg)	624 (283 Kg)	624 (283 Kg)	585 (283 Kg)	624 (283 Kg)
Oil 6.5 Gal. (lb.)	71 (32 Kg)	71 (32 Kg)	71 (32 Kg)	71 (32 Kg)	71 (32 Kg)
Misc. Equipment (lb.)	182 (87 Kg)	126 (57 Kg)	146 (67 Kg)		126 (57 Kg)
Ordnance (lb.)	124 (56 Kg)	178 (81 Kg)	815 (417 Kg)		400 (185 Kg)
Crew (lb.)	340 (154 Kg)	340 (154 Kg)	340 (154 Kg)	340 (154 Kg)	170 (77 Kg)
WING AREA (Ft.²)	246 (23 08 M²)	246 (23 08 M²)	262 (24 4 M²)	246 (23 08 M²)	225 (20 8 M²)
WING LOADING	18 1 (8 22 Kg)	18 1 (8 20 Kg)	17 8 (8 08 Kg)	15 5 (7 08 Kg)	20 4 (9 26 Kg)
POWER LOADING	8 9 (3 72 Kg)	9 0 (4 8 Kg)	8 36 (4 24 Kg)	8 8 (3 99 Kg)	5 46 (2 48 Kg)

All performance figures reduced to U S standard atmosphere and are guaranteed, with respect to speed, ceiling and take-off, to within 5 per cent

NOTES—Any of the above airplanes may be equipped with float type landing gear. Airplanes so equipped may also be used as land type airplanes by the substitution of the standard land type landing gear. High speed is reduced 12 m.p.h. on the "Fixed type landing gear" when float type gear is used and approximately 18 m.p.h. on "Retractable gear." The weight is increased approximately 300 lb. over the weight shown for land type gear.

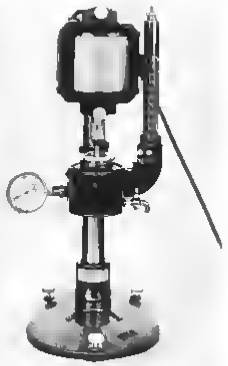
Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

Grease Tester

New machine designed to test stability of greases

As A POSITIVE MEANS of determining mechanical stability of heavy lubricants, the Taft-Peirce Mfg Co of Woonsocket, R I, has developed a new device The machine works a definite amount of grease in a moderate sized bearing running at medium speed at various temperatures It gives definite



The Taft-Peirce grease tester

information on starting and running torque, oil separation changes in structure and consistency aeration, etc It is equipped with a constant speed motor on which is mounted a plate-shielded 20¢ SAE bearing The latter is mounted in a grease cup which is free to turn, and the grease is brought to a predetermined temperature as recorded by a dial thermometer Accessories consist of a grease measuring cup melting point apparatus, and a BEC penetrometer

Fire Foam Maker

Pyrene announces new mechanical foaming device

FOR FIGHTING flammable liquid fires, a foam blanket has been found most effective Ordinary foam production is by chemical means, but Pyrene Manufacturing Co (Newark, N J) has just announced a new method, mechanical rather than chemical, that can be applied with long or short lines of hose ranging in size from ¾ to 2½ in By coupling the new Phomaire Play Pipe to a waterline supplying 75 lb per sq in. or more pressure, a continuous foam stream is produced. As the water passes through the play pipe, a small amount of a foam-making solution carried by the operator in a hip pack is automatically drawn into the water stream with a large quantity of air to produce the foam There are no adjustments and no moving parts. Water may be pumped from suction, hydrant or water tank. About 20 gal of water per minute are required. One gallon of the Phomaide solution makes 350 gal of foam Either a water stream or a foam stream may be produced at the nozzle by simply removing or placing the pick up tube in the solution.

Portable Heat Gun

Hot air blower finds many uses in cold weather

AROUND maintenance shops and airports many uses should be found in the wintertime for a device such as the Black & Decker (Towson, Md) portable electric heat gun This compact unit, designed for developing concentrated heat combined with a positive blowing action consists of a three-stage centrifugal fan in an aluminum housing which forces air through the nozzle at the rate of 8 cu ft. a minute A michrome heating element mounted on a lava cone in the nose develops 400 deg F maximum temperature The heating element is insulated from the housing by means of asbestos sheathing The heat gun may be used for thawing frozen grease in any kind of mechanism; thawing out radiators, water pumps, hose connections; drying spark plugs, distributors, ignition wires, brakes, warming up carburetors, etc It comes with a wide range of accessories of different shapes to be mounted on the nozzle Its net weight is 5 lb., overall length (not including attachments) 14½ in It is designed for 110 volt a.c but also available for 220, 250 volts Standard equipment consists of a three-conductor cable with plug, 750 watt heating element, and six nozzle attachments

The Black & Decker portable electric heat gun in action

Anti-Corrosive

Compound prevents corrosion in outdoor floodlighting equipment

THE ACHESON COLLOIDS CORP. of Port Huron, Mich., has developed a compound to prevent corrosion in the bases of incandescent lamps used for outdoor floodlighting and other similar purposes, which frequently tend to corrode on exposure to the weather Corroded lamps are difficult to unscrew, frequently fracture in the hand, sometimes with serious physical results Usually also a corroded socket must be replaced

This difficulty can be avoided by applying to the lamp base an aqueous suspension of colloidal graphite Such films are electrically conductive and at the same time are anti-corrosive Graphite in this form is applied by spraying or brushing after the surfaces have been cleaned and are free of grease After treatment, lamp bases and fuse plugs should not be used until the anti-corrosive film has dried thoroughly

Nozzle Improvement

Milburn announces changes in fluid nozzles and atomizer heads

RECENT CHANGE in the design of paint spray equipment manufactured by Alexander Milburn Co. (1416 W Baltimore St., Baltimore, Md) includes an improved design of fluid nozzle The new equipment is made of special wear-resisting steel with long tapered seat, accurately machined for good alignment with atomizer head Large air passages, closely spaced, provide an annular air supply to the atomizer head. Internal tapered seat is accurately ground to allow the paint needle point to seat accurately and prevent dripping or spattering

New fluid nozzle and atomizer head by Milburn of Baltimore

The new bronze atomizer head is of a one-piece design with straight air passages to eliminate friction and to make it easy to keep clean. Both the new fluid nozzles and the atomizer heads are manufactured for syphon or force feed and in sizes and styles to handle any type of painting material

Conversion Kit

To bring AVR-7 or AVR-7A sets up to date

OWNERS of AVR-7 and 7-A RCA (RCA Manufacturing Co., Camden, N. J.) radio receivers can now bring their equipment up to date by using the AVR-9 conversion kit Equipment in the kit consists of a new control panel assembly including a new improved remote band change cable, a small gear box matching the tuning control head in ratio; cable, coupling unit; fittings and screws. AVR-7 or AVR-7-A dials scales may be supplied at the option of the customer

Safety Fuse Mounting

Quick replaceable fuse for aircraft and radio power circuit

LITTELFUSE LABORATORIES (4238 Lincoln Ave, Chicago, Ill) has developed a new type mounting for the special aircraft anti-vibration Model 4 AG fuses. Fuse clips are mounted on a sub-panel and the fuse itself is placed as shown in an insulated knob holder

Littelfuse panel safety mounting

and plugged into the clip with the knob element flush with the outer panel. With this equipment, fuses may be quickly replaced without the need of fumbling about in cramped quarters. There is no danger of dropping fuses accidentally in confined spaces

Electric Hand Drill

Lightweight ¼ in. portable drill for use in close quarters

A NEW MODEL OB-4 ¼-in electrical portable drill has been announced by the Signal Electric Mfg Co of Menominee Mich. It is powered with a Signal Universal motor for direct or alternating

Signal ¼ in. drill

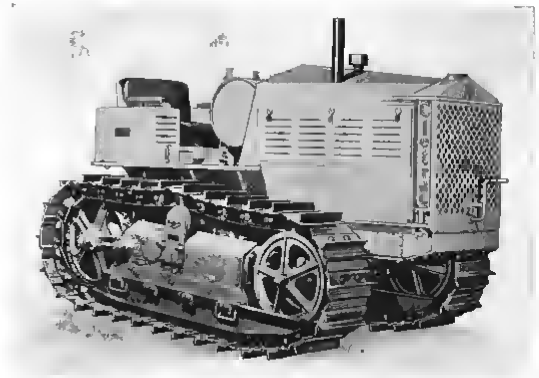
current. No load speed is 1,700 r.p.m. Cord connection is in the handle as is the control switch Drill is made of aluminum alloy, and gears are cut from alloy steel heat treated An Almond three-jaw chuck is standard equipment. Each drill is fitted with 8 ft of heavy duty rubber covered cord and rubber covered plug

33 hp. Tractor

Cletrac develops machine suitable for airport work

A NEW 33-hp tractor, Model 30, useful for airport grading work, has been developed by The Cleveland Tractor Company (Cleveland, Ohio) The engine is six-cylinder, 3¼x4½, with force-feed lubrication to connecting rods and timing gears. It has seven main bearings. Starting is electrical, ignition by battery, with magneto ignition available as special equipment.

The tractor weighs 7,950 lb, and has a speed range from 1.75 to 4.25 m.p.h. An automatic transmission brake makes speed changes easy It has an eight foot turning radius and is available with special track widths and cleat assemblies for hillside and swamp work



Cletrac's new 33-hp tractor

Among other things, I'm editor of the screwiest page written. And like all editors, I'm nosey and snooping for news. So sharpen an old valve stem, dip it in Gulfpride that's been used for about 500 hours (under that, it's too clean)—and send some spare parts from your gossip bin. High tension lies are just as good as true stories—but they gotta be good

Editor—AL WILLIAMS (alias Tattered Wing Tips)
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

FARMER TAKES A RIDE

A captain in the French army is said to be the first man ever to have made a sustained flight in his own glider.

The machine weighed 90 pounds and looked like an albatross. One day he placed the contraption on a farmer's cart, then had the farmer whip up his horse to a fast trot.

When the horse got going, the captain lifted the front edges of the wings and the albatross sailed upward. Unfortunately, the mooring rope whipped around the farmer's waist and hoisted him skyward with the glider.

The fellow howled so loud that the officer took pity, sailed close to the ground and let him drop, intending to soar away into the clouds.

But, minus its ballast, the albatross didn't navigate so well, so the daring Frenchman brought her to earth and called it a day. At least, that's *his* story.

—H H.

RAISED EYEBROW DEPT.

Do they put lead in Gulf Aviation Gas to weigh it down? If so, please put more lead in the next batch. This gas still makes my plane go too fast.

—J.D.

PIGEONS BEAT PLANES

Until some one invents a plane which will land in a city editor's lap, pigeons will be one up on planes for short hauls.

A New York paper uses the birds to hustle negatives from metropolitan football games to the newspaper office. About ten minutes after the picture is snapped, the negative is in the dark room.

—H B.

SCARED-Y CAT

I have a friend who makes a living as a stunt pilot. The other day I took my young nephew out to see him.

After performing his quota of barrel rolls, loops and spins, he landed and took the youngster around the fair grounds.

When the kid tried to get the pilot to accompany him on a roller coaster, my friend replied, 'Get me on one of those things? I should say not! Why I wouldn't trust my life on them.'

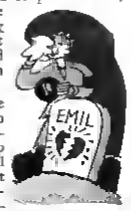
—I Z.

THIS MONTH'S WHOPPER

I raise whippets. You know, those racing dogs that chase an electric rabbit down the track, first dog to finish wins.

Well, sir, I had a dog I called Emil. This dog was so slow it made you tired to look at him. That is, he *was* slow until one day I rubbed him down with some Gulfpride Oil instead of his usual dog liniment. From then on that dog changed. Gosh, he started to beat the rabbits in.

And I started cleaning up. Emil got so's he'd sleep till the door of his box clicked open, yawn a couple of times, stretch himself, give me a wink and *whiz-z-z*—he'd pass the rabbit like a shot and we'd have another race in our pockets.



Then one day we had the tough luck to run on a track operated by an aviator who knew all about Emil and Gulfpride. That guy—now get this—soaked his *electric rabbit* in Gulfpride! Gee, it makes me sore and it makes me sad to think of what happened.

That gol-dern hopper beat my Emil in. When my poor dog realized the rabbit had come in first, he just went to pieces. Ten minutes later he died of a broken heart.

"I blame it all on that aviator and your danged Gulfpride Oil. So, I'm warning you—I'm packing a gun."

—A J S.

Operators' Corner

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 17: What is your opinion of the D of C approved school regulations? Do you consider it worth while for an operator to go to the effort and expense involved in operating an approved school? If your school is approved, does your experience indicate that it has helped your business? In what ways has it been specifically helpful? Have you any suggestions for modification of regulations? If your school is not approved, what reasons have led you to avoid the approved status? Would any change in the regulations make approval worth while to you?

Regulations don't make pilots

MY observation of the approved school as regulated by the Department of Commerce is nothing short of almost complete disgust. The function of an approved school in the aviation business is vital. There is no question about the advisability of a person taking a course at an approved school if that person intends to make aviation his vocation. For a transport course the approved school is the only solution. On the other hand regulations as applied to other courses are a rank injustice.

The average small operator derives a large part of his income from customers who like to fly for various reasons. Generally this small operator is the support of the airport. The Bureau of Air Commerce in its wisdom has already licensed the transport pilot to instruct all comers in the business of flying airplanes, then the Bureau turns right around and says that a transport pilot employed at an approved school can put up a student for a license with as much as ten hours less solo time than the run of the mill field transport. In other words, if a field wants to compete with an approved school it has to give $100 worth of flying free. This leads to writing up false time in logbooks and I do not know any way the Bureau can detect such false time. I do not doubt that this is an everyday practice.

The above suggests a change in the regulations to the effect that approved schools must operate on the same basis for the primary licenses as any other source of instruction. Either the schools should be compelled to give a full 50 hours solo course or the unapproved should be allowed to put license applicants up with 40 hours solo.

The operator at the Framingham Airport does not run an approved school. That is, the operator, Air Services, cannot advertise that it is an approved school. My contention is that it is an approved school. The Bureau has approved of the mechanics by issuing them licenses. The transport pilots are approved as they have Bureau licenses and the planes are approved as they are likewise licensed by the Bureau. As a matter of fact one of the planes has just come back from an approved school where it was used for several months. The whole answer is that regulations do not make pilots. The answer to many a crack-up is that the pilot ran out of knowledge and I do not believe that the Bureau can put itself in the position to say that approved schools have a corner on the knowledge market. No sale on approval here.—R. C. CODMAN, *Framingham Airport, Inc., Framingham, Mass.*

Approval an advantage

DURING the period in which I operated a flying service I found that it was just as profitable to operate an approved school with the 40-hour requirement for private license as it was to operate an unapproved school with the 50-hour requirement. In other words there was no additional profit in the long run in stringing out the hours of instruction.

Furthermore an approved school has the advantage of being able to advertise its approval. The 40 hour requirement is also an advantage as is the necessity for a proper ground school to maintain the approved status.

It is very likely that the hour requirements for private licenses in both approved and unapproved schools could be reduced somewhat without any serious risk. I would strongly recommend that more operators get approval for their schools. The examination is long but not difficult. The most unusual thing about it is that it requires the applicant to be able to describe maneuvers in writing.—JOHN M. DONALDSON, *Oklahoma State Aviation Commission (formerly president, Donaldson Flying Service, Birmingham, Ala.)*

Nine out of ten unfair

THE requirement that an approved school graduate nine out of every ten students is manifestly unfair as the stage fright of student pilots coming up for their examinations may lower the average.

In my experience students come out regularly until solo and then their interest slows up. At about 22 hours they refuse to practice landings and, when the time comes for their examination, they expect to brush up in one afternoon. The 20-hour man under the old license requirement was a better examination flyer than the present private pilot of 50 hours. 20-25 hours, if it was strictly instruction time, would be ample for a private license.—L. G. MASON, *Montgomery Municipal Airport, Montgomery, Ala.*

Too expensive

THE expensive outlay for equipment required under the approved school regulations is not justified in our operation. I do not believe that approval would increase our business sufficiently to justify the increased expenditure for equipment and for conformance with the regulations.

Most of our students are business men and women who want to fly mainly for fun and take time when they can. While a large proportion of them go through to get their licenses, there is a considerable turnover among the remaining few and the "nine out of ten" requirement is therefore unfair to this type of school we operate.

Conformance with the existing regulations would make it difficult to maintain our present rates for instruction.—EDWARD GORSKY, *Manager, Standard Aviation, Inc., Teterboro, N. J.*

Question 18

(Answers to be published in October)

WHAT is to be done about the problem of the young student who has learned to fly with an established operator and wants to go into business for himself? Should the parent school encourage him by assistance of various kinds, or should it treat him as a possible competitor? Is it good business in the long run to try to sell him a ship, find an airport for him and instruct him in operating methods; or should the older school confine its activities to instruction alone?

Question 19

(Answers to be published in November)

WHAT method do you employ to insure competition of charter service within the time agreed upon between yourself and your prospect? How do you compute the necessary leeway between the promised arrival time and the cruising speed of the airplane? Do you hold standby equipment ready to overtake your ships if they are forced down by mechanical trouble?

News of the Month

Highlighting recent events in the aviation world.

★ ***Domestic Transport*** **. . . TWA announces a $2,500,000 re-equipment program, calling for eight modified versions of the Douglas DC-3 . . . $3,000,000 stock flotation proposed by United for purchase of 20 DC-3s . . . 100 per cent operation on many American Airlines routes . . . Pan American sets up weather station in Iceland.**

★ ***Races*** **. . . National Air Races time again, with many new or revamped ships awaiting the starting gun . . . England's King's Cup Race is run and won entirely on Gypsy engines.**

★ ***Army*** **. . . Stages mid-west maneuvers; orders 150 G-Cyclones, three experimental Curtiss pursuits; opens bids on basic trainers.**

★ ***Industrial*** **. . . Lockheed reports sale of seven twin-engined ships . . . 25 Menasco engines to Ryan, 25 to Stearman-Hammond . . . Ryan, turning out one plane a week, builds new $50,000 unit . . . 21 planes in two months reported by Rearwin . . . Aircraft Associates will assemble Taylor Cubs on the west coast.**

★ ***Financial*** **. . . Almost all reports show profit.**

Races West

The annual proving ground moves to Los Angeles promising new planes, new speeds, and richer rewards.

FOR THE THIRD time since the beginning of the thirties, the National Air Races of Cleveland, Inc., will hold their show in another city. This year they go back to Los Angeles, scene of the 1933 races which produced the present East-West transcontinental record of 11 hours 30 minutes, set by Roscoe Turner. Auguring success, $100,000 in advance ticket sales was reported a week before race time.

This year's races will offer a minimum of $70,000 cash prizes. The first day will feature the finish of two fixed-feature races. The first is the Ruth Chatterton Sportsman Pilot Derby, which left Cleveland, 32 strong, Aug. 29 on a seven-day series of handicap laps, and will wind up at Los Angeles on Sept. 4. The other race, one of the major events, is the Bendix Trophy Race, which will leave Floyd Bennett Field in New York in the dawn on Sept. 4 and will end at Los Angeles by 6 p.m. the same day.

First old-standby to meet with disaster was Roscoe Turner, whose repowered Wedell-Williams 57 was entered in both the Bendix and the Thompson Trophy races. He was picked as outstanding favorite in the Thompson and darkest horse in the Bendix by AVIATION'S Special Agent No. 1313X (see page 18). But, flying East for the transcontinental dash, he broke his throttle near Gallup, N. M., and washed out his ship, though he walked away with a few scratches.

Also out of the Bendix starting line was Jacqueline Cochrane (Odlum), who crumpled a wing of the Vance Breese in a forced landing with the wheels up.

The purse in the Bendix Trophy race has been increased this year from the customary $12,500 to $15,000, $4,500 going to the pilot with the shortest elapsed time. If he breaks the present 11-hour, 30-minute record he gets another $2,500. The added $2,500 is for award to women competitors, whether or not they place in the race or break the record.

Two of the remaining Bendix entrants, S. J. Wittman and Benny Howard, are also entered in the Charles E. Thompson Trophy race, international closed course free-for all open to men pilots only. This race has a total purse of $20,000, with $8,000 going to first place, and an additional $2,500 if the winner also breaks the present 252 m.p.h. record. Thus either of these two may go home Sept. 7 $17,500 richer than he was in the cold dawn of Sept. 4. The qualifying speed in the Thompson Trophy Race is 225 m.p.h., which is 5 m.p.h. faster than the winning time last year, set by Harold Neumann in Benny Howard's Mister Mulligan at Cleveland. As usual, the Thompson will be the smashing last act for expectant spectators straining in their seats as the ships hurtle around the pylons.

Foreign speed competition will come chiefly from Michel Detroyat of France, who will fly a 300 hp. Renault-powered Caudron. He is entered in both the Bendix and Thompson Trophy races. A similar ship set a pace of 275 m.p.h. in a 1,242 mile race in France in 1935. Detroyat will represent the Aero Club of FRANCE.

ELECTRA, EARHART UP

Mrs. Putnam sits possessively on her new Lockheed which will be used to study reactions to the human element under various flight conditions. Purdue University is sponsoring the venture.

FOREIGN INVASION

for the National Air Races Michel Detroyat, who will fly a Renault-powered Caudron. It should provide stiff competition in the Greve and Thompson Trophy races.

RACE FLASHES

Chatterton Derby—Frank Spreckels—Luscombe Phantom—1 184.8 pts out of 1 200

Bendix Trophy—Louise Thaden—Whirlwind Beechcraft—14 hr 54 min 49 sec

Shell Trophy—Harold Neumann — Menasco Folkerts Special — 223.204 m p h

Greve Trophy—Michel Detroyat —Renault Caudron—247.3 m.p.h.

Thompson Trophy—1st Michel Detroyat — Renault Caudron — 264.261 m.p.h.

Maneuvers, Orders

Raids in the Mid-West; 3 Curtiss pursuits; basic trainer bids

THE LARGEST concentration of troops in the Middle West since World War days was held early in August for maneuvers of the Second Army. Twenty-five thousand troops from the Fifth Corps area, Kentucky, Indiana Ohio and West Virginia, were mobilized at Fort Knox, Ky. An opposing army of 24,000 troops of the Sixth Corps area from Illinois, Wisconsin and Michigan concentrated near Custer, Mich. On the first day of the maneuvers, eighteen Martin bombers from Langley Field raced the 670 miles to Chanute Field, Ill., arriving simultaneously with fourteen Northrop attacks from Barksdale Field, Shreveport, La. After five minutes of intensive ground strafing by the attacks the bombers got in their work. Fifty pursuits from the First Pursuit Group at Selfridge Field, Mich., defended the base. Similar raids went on for over a week, but the results have not been announced.

To make future operations still more effective, the army Aug. 3 placed a contract with Wright Aeronautical for 150 of the 1,000-hp G-Cyclones. Total cost will be $1,327,190. They will be installed in Douglas bombers.

To Curtiss Aeroplane & Motor Co. went an army order for three single-seated pursuits, known as Y-1P 36. They are low-wing, all-metal monoplanes, built from Air Corps specifications. Engines will be of 900 hp., though the make was not specified. The War Department release says that "aeronautical engineering developments which cannot be described at this time" will be built in the planes.

In the basic training category, the Materiel Division at Wright Field, Dayton, Aug. 17 opened bids submitted by North American Aviation Corp., Seversky, and Northrop. Bid prices were as follows: North American, $12,600 each for 25 and $10,710 each for 200; Seversky, $16,100 each for 25 and $11,500 each for 200; Northrop, $25,000 each for 25, and $16,750 each for 200. All prices were without engines. Design tests on the prototypes will be carried out at Wright Field for evaluation purposes prior to award.

Order Backlogs Grow

Coordinating committee; orders for seven new Lockheeds; Menasco sells 50; 21 Rearwins delivered

TO HELP coordinate activities of Bay Area manufacturers, operators, and private flyers, fifteen representatives from neighboring cities met Aug. 12 in San Francisco to form the San Francisco Bay Area Aviation Industry Development Committee. Emory Bronte was elected president. The committee will meet once a month and all its data will be available on request.

IRVING AIR CHUTE'S Canadian subsidiary, at Erie, Ont., has received a contract from the Canadian Department of Militia and Defense for 70 parachutes.

Unfilled orders for LOCKHEEDS mounted to more than $700,000 early in August with receipt of orders for seven new twin-engine transports, totaling approximately $320,000. Three of them are standard Electras for the Army Air Corps one is an Electra for Canadian Airways, and one for Guinea Airways. Both of the latter have already received one Electra. The new Lockheed 12 (see p. 33) has proved so acceptable that five of them, at $40,000 each, have been sold. Announced sales are for one each to the Department of Commerce, Continental Oil Co., and an unnamed English sportsman flyer.

MENASCO MANUFACTURING Co. has announced a $30,000 order from the RYAN AERONAUTICAL Co., San Diego, for 25 engines, chiefly 125-hp (C4s), but also including 95 hp and 150 hp Models B4 and C4S. Another 25 engines have been ordered by the STEARMAN-HAMMOND AIRCRAFT CORP. These are all C4's for installation in the Hammond Pusher C6S Buccaneers.

Acme

JUMP-OFF GIRO

Juan de la Cierva in the cockpit of the Weir W.5 developed by the British firm of G. and J. Weir. Note the two-bladed rotor, mounted on the 'autodynamic' rotor head. In a recent demonstration, 12 and 14 ft. jump take-offs were accomplished.

and C6S-4 Super-Buccaneers are being shipped regularly to England, Australia and Japan. Additional equipment has been installed in all departments at the Menasco plant and the payroll has been approximately doubled in the past six months. A two shift work schedule is turning out engines at the rate of fifteen per month.

Antonio L. Seabra has been appointed RYAN AERONAUTICAL CO.'s representative at Rio de Janeiro, Brazil. First Ryan S-T was scheduled to leave for South America from San Diego on Aug. 17. To take care of growing demands for Ryan S-T's, a new $50,000 steel and concrete unit is being constructed at the company's Lindbergh Field plant. Some departments are already working in three shifts, 24 hours a day, turning out one plane a week.

Permission has been granted PASPED AIRCRAFT CORP., Los Angeles, to sell 6,500 shares of $1 par value common stock. Authorized capitalization is $75,000. The company reports orders for four Skyriders, a small private plane to sell at around $1,600.

During June and July, 21 Rearwin Sportsters, manufactured by REARWIN AIRPLANES, INC., Kansas City, were delivered, some going as far afield as South America and South Africa. The Sportster has been approved for an additional 50 lb. of useful load, bringing the gross weight up to 1,460 lb.

Maj. James H. Doolittle, aviation representative of the SHELL PETROLEUM PRODUCTS CO., has ordered a commercial version of the new SEVERSKY pursuit for his personal travel use and as a flying laboratory for experiments with aircraft fuels. The ship has a high speed of over 300 m.p.h. and a cruising range of 3,000 miles.

AIRCRAFT ASSOCIATES, Long Beach, Calif., has begun construction of an assembly plant and branch factory of the TAYLOR AIRCRAFT CO., for West Coast assembly of Taylor Cubs. They will also cover and dope wings and fuselages.

Delivery of the first of six flying boats ordered by the Coast Guard from the VIKING FLYING BOAT CO., New Haven, Conn., is scheduled for Oct. 20. The last one will be delivered about the middle of November, according to J. L. Freed, general manager of the company. The total contract price is $67,000.

The boats are biplane pushers, powered with 250 hp. Wright J-6 engines. Hull bottoms are flat, to allow easy landing along the shore. With 60 gal. of fuel, the ship will cruise 400 miles at 90 m.p.h.

COAST GUARD VIKING
for service on the Atlantic Seaboard

Calendar

Sept. 4-5-6-7—National Air Races, Los Angeles, Cal.

Sept. 23-26—Sixth Annual Convention, National Association of State Aviation Officials, Hotel Bond, Hartford, Conn.

Oct. 13-16-17—National Aircraft Production Meeting of the S.A.E., Ambassador Hotel, Los Angeles.

Oct. 25—Paris-Saigon Air Race.

Nov. 13-29—Fifteenth International Aero Exhibition, Paris, France.

Jan. 28-Feb. 6, 1937—Aircraft Show, New York.

TWA, United to Re-Equip

Extra schedules for Bramff; Lockheeds in Canada; traffic records set by Central, National Parks

MAJOR AIRLINE NEWS of the month centered around equipment renovation and replacement. First to announce a new program was TWA's president, Jack Frye. It involves an expenditure of about $2,500,000. Most important item is a $1,950,000 fund for purchase of the nucleus of a fleet of new planes.

These will be, essentially, Douglas DC-3s, however, following regular line policy of laying down their own specifications for their equipment, the ship will incorporate a number of modifications suggested by earlier DC-3 performance plus the best of suggestions from passengers, pilots and Douglas engineers culled from an intensive analysis covering a period of over two years. Present tentative plans call for eight of the super-transports.

Next important item in the TWA program is an appropriation of $350,000 for extensive engine modifications on the line's 27 DC-2s. Present engines are Wright Cyclone R1820-F3s which will be converted to F-52s by replacing cylinders and cylinder heads. The new cylinders will have their bearing walls treated with the recently developed nitriding process. New cylinder heads will feature cleaner and redesigned fuel intake passages. These changes will result in harder, longer-wearing cylinder walls and a marked decrease in fuel consumption.

The third phase of the Lindbergh Line program will be a series of experimental flights at high altitude. First transcontinental flight, to be made by D. W. (Tommy) Tomlinson, is scheduled soon after the middle of September. Flying equipment will be specially developed Northrop Gamma.

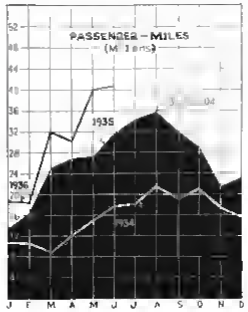
Second big re-equipment program is for United Air Lines, was announced Aug. 25 in a special letter to stockholders. Additional stock will be offered to realize a net of from $3,000,000 to $4,000,000, if stockholders meeting on Sept. 23 vote favorably. They will be asked to authorize issuance of 600,000 additional shares. The proceeds will be used for the purchase of 20 Douglas DC-3s, and also to supply money for possible purchase of DC-4s, the prototype of which is now building at Santa Monica. The announcement that 20 DC-3s would be bought shows a third change of mind on United's part. In February the line announced that it would buy ten; in May the figure jumped to fifteen; and now it stands at twenty.

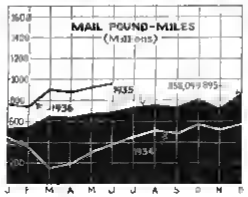
Ralph S. Damon, American Airlines' vice-president in charge of operations, has reported a number of 100 per cents for his department for July. One hundred per cent of scheduled flights were performed over the line's Chicago-Fort Worth, Cleveland-Nashville, New York-Los Angeles, and New York-Chicago routes. For all routes 98.4 per cent of scheduled flights were completed (1,326,824 miles out of a scheduled 1,348,302).

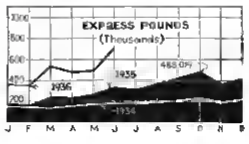
New schedules providing two additional services daily for Corpus Christi have been announced by T. E. Braniff, president of Braniff Airways. He also reported spectacular increases in traffic for July 1936 over July 1935, total sales being 72 per cent greater this year than last. This in spite of a 10 per cent reduction in daily scheduled miles. Express poundage increased

Traffic

Latest available statistics from the Bureau of Air Commerce and the Post Office Department—Domestic airlines only







nearly 200 per cent over the corresponding month of last year.

Lockheed Electra equipment has been placed in service for two daily round-trip schedules between Vancouver, B. C., and Seattle, Wash., by Canadian Airways, Ltd.

A 31 per cent increase in passenger traffic for July over June is reported by D. Walter Swan, vice-president in charge of traffic for Central Air Lines. This represents a 466 per cent increase over July, 1935.

Once more Delta's plea before the Interstate Commerce Commission for increased mail pay has been postponed, this time until Sept. 21.

Competition for American Airlines on its New York-Boston run faded into nothingness Aug. 3, with the announcement by the Securities and Exchange Commission that it had granted the request of Marine Air Lines, Inc., to withdraw its registration statement for the issuance of stock. Marine Air Lines was formed last spring to operate a seaplane service between the landing floats in New York's East River and the old Fish Pier at Boston's waterfront. Equipment was to have been Sikorsky S-43s.

The attraction of flying over Yellowstone Park helped to establish a new passenger traffic record for National Park Airways in July, according to Alfred Frank, president of the line. The month's mark was up 114 per cent over July, 1935, and 79 per cent over the previous high mark set in June of this year. Passenger revenue was up 96 per cent over July, 1935, and 63 per cent over June of this year.

More pioneering of the Pan American type is evidenced in the departure of Paul Oscanyan for Reykjavik, Iceland, where he will open a radio weather reporting station to compile data for North Atlantic passenger operations by PAA.

Missouri Crash

Eight die in C&S airliner; Salt Lake crash findings announced

THE FIRST fatal crash on Chicago and Southern Airlines occurred Aug. 5 at St. Louis. The Lockheed Electra "City of Memphis," bound for Chicago on its regular evening run from New Orleans, landed at Lambert-St. Louis Field about 9:30 p.m. The pilot, James Benedict, turned the ship over to Pilot Carl Zier. Co-pilot Russell Mossman, who had been Benedict's co-pilot from New Orleans, was scheduled to go on through to Chicago.

Lawrence Jewell, field dispatcher, cleared Zier and his passengers from St. Louis by radio at 9:56. At 10:02 he gave Zier a call, but got no reply. As the next call was scheduled for 10:20, he did not try again.

The Electra appeared to gain altitude slowly, and had been out but a few minutes when it made a wide swing to the left, heading back to the field. About 4 miles from the airport, the left wing struck, cartwheeling the plane for about 140 yd. All eight people—the six passengers were all men—were killed instantly.

Bureau of Air Commerce investigation into the crash is being conducted by Maj. R. W. (Shorty) Schroeder. Early testimony showed the following conditions: wind was from the north at about 3 m.p.h. The weather broadcast at 9:41 gave the ceiling of St. Louis as 1,800 ft., visibility ¾ mile; half an hour later the ceiling had dropped to 500 ft., with visibility the same. Ceiling at Springfield, Ill., was 800 ft. with a mile of visibility, and Chicago had an unlimited ceiling.

Mechanically, the plane seems to have been functioning perfectly. The crash occurred with landing gear retracted and power apparently full on. No irregularities were recorded in the ship's log when it was turned over to Zier.

The long-mysterious wreck of the Standard Oil Co. of Calif. Douglas DC-2, which had a forced landing in great Salt Lake last Oct. 6, was explained by the Bureau of Air Commerce early in August. After the plane was removed from the 24 ft. of water in which it rested, it was carefully examined for any failure that might have caused the accident. The only condition that could not be ascribed to the water landing, long submersion and salvage operation, was a broken retaining bar on the left fuel strainer. It was determined that this break would allow a leak of air into the fuel line, causing failure of both engines.

ADJUSTABLE LOOP

antenna for TWA Douglases. The special insulation, developed by TWA engineers, reduces rain and dust static to a minimum.

Production Meeting

S.A.E., Chamber, A.T.A. will sponsor sessions at Los Angeles

AS EVIDENCE of the increasing trend on the part of aircraft manufacturers and airline operators toward cooperative action to solve their common difficulties, the Society of Automotive Engineers, the Aeronautical Chamber of Commerce, and the Air Transport Association, will jointly sponsor a National Aircraft Production Meeting in Los Angeles, Oct. 15, 16 and 17.

Papers will be presented on fifteen

PRODUCTION MEETING

Ralph R. Teetus, president of the SAE and General Chairman Carleton E. Stryker, who is chief engineer of the Curtiss Wright Technical Institute of Aeronautics.

topics relating to production methods materials, design, and operation General chairman of the meeting is Carleton E. Stryker, chief engineer of the Curtiss-Wright Technical Institute of Aeronautics Chairman of the various sessions will be Hall Hibbard, vice-president and chief engineer, Lockheed Aircraft Corp, for factories and equipment, L H. Steward, Bureau of Air Commerce, for aircraft materials and processes; and W. A. Hamilton, system maintenance superintendent Transcontinental & Western Air, for the operation and maintenance session There will also be sessions on engines and production design Stryker will be assisted by Obie Chenoweth and Mac Short, vice-presidents of the S A E

The honorary advisory committee of the meeting includes fifteen presidents of aircraft and aircraft engine companies, six presidents of airline operating companies, and 30 other ranking men in the industry

In-Lines In Line

Every King's Cup entrant Gipsy-powered; Percival Gull wins

WINNER of this year's King's Cup, England's annual handicap race classic, was Charles Gardner, who flew a Percival Vega Gull against a field of 27 His time in the finals was 164.5 m p h Second was Flight Lieut Tommy Rose (last year's winner), who made 184.5 m p h in a Miles Hawk. Fastest time, 203 m p h., was made by Capt Edgar Percival, in one of his own Mew Gulls Most consistent winners were the inverted in-line De Havilland Gypsy engines, which powered every entrant.

The first day of the race starting at Hatfield Aerodrome, was a double circuit of a 612 mile course, with five control points at which compulsory stops were made Any other stops were allowable, but time out for all stops was included in the results

This long circuit was simply an elimination round, and a basis for handicapping—the 50 per cent of the contestants finishing in the best time being eligible for the finals the next day Planes were divided into three classes single-engined up to 150 hp, single-engined more than 150 hp, and multi-engined

The final round was twelve times around a triangular course of 26 miles, starting and finishing at Hatfield This was a handicap race based on estimated performance from the results of the previous day's 1,224 mile grind To the winner went the King's Cup and a £500 prize presented by Lord Wakefield of Hythe £200 went to the second and £100 to the third in the finals, and £50 to the entrant in each class making the fastest time in the eliminating round

Shopping by Air

Exotic delicacies brought quickly by Air Express

LATEST WRINKLE in the fabric of air express, which is weaving back and forth across the country in ever-increasing quantities, is a boon to the epicurean midlander It is a service known as Air Shopping, conducted by Air Express Division of Railway Express Agency When an eager-to-please host throws a party in Omaha and wants to delight his guests with fresh seafood, he has simply to pick up his telephone and call any Railway Express office, and state his needs The agent will immediately dispatch a telegram to J H. Butler, the agency's general manager in New York, ordering for his customer Stone Crab Claws, at $2.50 a dozen or Turtle Soup at $1.50 a quart jar. These will be promptly shipped by air express

The service, of course, is not limited to exotic foods You may order Centennial Roses from Texas, a Paris gown from Fifth Avenue or Satsuma blossoms from Florida

Financial

Almost all reporting companies show profits through first half

SALES and other income for BOEING AIRPLANE Co. in the second quarter of 1936 amounted to $649,528 compared with sales of $803,640 in the first quarter of the year Total for the first half of this year comes to $1,453,168 compared with $466,112 in the same period last year This year's first half is about 16 per cent over the total sales for 1935.

With unfilled orders of approximately $13,000,000 on its books, CONSOLIDATED AIRCRAFT CORP. closed the second quarter of the year with a net income after depreciation, Federal income taxes and other charges of $184,950.

DOUGLAS AIRCRAFT'S profits for the six months ending May 31 amounted to $194,612, compared with a $936,002 profit for the same period last year.

THE B F. GOODRICH Co has reported net sales of $65,994,521 for the first six months of 1936, up $11,000,000 over the corresponding period last year Profit was $2,727,606, including $108 661 on the sales of securities

NATIONAL AVIATION'S net profit for the six months ending June 30 was $342,502

First half profits for NORTH AMERICAN AVIATION amounted to $86,027 compared with a net loss of $102,820 for the first half of 1935.

Including a profit of $1,055,204 from the sale of securities, the SPERRY CORP. was able to announce a profit of $1,657,305 for the first half of 1936 Last year's profits, for the same period were $809,752, which included a $57,184 profit on the sale of securities Thus indicated net profit resulting from operation was $602,101 for the first six months of this year against $752,568 for the same period in 1935

UNITED AIRCRAFT CORP earned 8 cents per share or $197,607 for the quarter ended June 30. Total net profits for the six months ended June 30, amounted to $548,559, or 24 cents a share Sales of aeronautical products, parts and service, proceeds from sale of design and manufacturing rights and licenses and royalties from licenses came to $6,855,736

WACO AIRCRAFT Co has reported a net loss of $32,031 for the first six months of 1936.

Schools, Services, and Airports

A state-by-state tour of the flying fields

• ALABAMA—The WPA has released $65,300, to which the city will add another $3,500, for construction of the second concrete runway at Bates Field, MOBILE. The HUNTSVILLE Board of Aldermen has taken an option on a 150 acre site, 3 miles from the city, which will be used for an airport. Price is set at $8 000. A 5,200-ft runway is being developed at Maynor Field, TUSCALOOSA's Municipal Airport.

• ARKANSAS — The JEFFERSON COUNTY branch of the Arkansas Centennial Commission sponsored an air show at PINE BLUFF July 11 and 12. The ninth annual Arkansas Air Tour reached its end at Toney Field on the first day of the show. Twenty-eight planes participated in the tour.

LITTLE ROCK is planning to seek WPA assistance for the construction of a hangar and administration building at the Municipal Airport. HOT SPRINGS has been selected as an overnight stop in the Ruth Chatterton Transcontinental Sportsmen Derby prior to the National Air Races in Los Angeles.

• CALIFORNIA — According to Don Smith, manager of the SACRAMENTO Municipal Airport, the increase in flying activity at the field for the first six months of this year has been greater than at any time since its dedication. Twenty-three commercially operated planes are based in the main hangar, and nearly 60 students are training at the various schools on the field. Eddie Martin's Airport, SANTA ANA, was planning an air show late in July featuring parachute jumps and a program of stunt flying by Joe Rust in one of the Martin Flying School's new ships. . . . A bid of $677,000 has been received for construction of the YERBA BUENA shoals airport.

An air and industrial exposition was scheduled for Aug. 22-30 at Grand Central Air Terminal, GLENDALE. The aerial part of the program was under the direction of Major C. C. Moseley, manager of the field.

• COLORADO—Installation of radio beacons and enlarging the eastern end of the field at DENVER Municipal Airport will cost $125,000.

• CONNECTICUT—The HARTFORD *Times* has bought a Lycoming powered 4-place Stinson. The pilot will be Horace B. Wetherell, who also operates a flying service at Rentschler Field with Albert Madden as pilot. . . . State Aviation Commissioner Charles L. Morris has written an open letter to the mayor of BRIDGEPORT, asking for a public hearing before Common Council on the question of purchasing Mollison Airport. . . . An addition to the hangar of the Descomb Flying Service is being built at Brainard Field, HARTFORD. It will be 62x12 ft., and will contain offices, waiting room, and stock room. The present hangar will be reconditioned and painted.

• DISTRICT OF COLUMBIA—Two-way radio has been installed at Washington-Hoover Airport to direct air traffic, replacing the light gun method. C. B. Walter is the control tower operator. . . . A three-man subcommittee of the DISTRICT Airport Commission, appointed by Congress at its last session to select and recommend to the President a site suitable for an airport for the District, has begun its task of investigation. The subcommittee consists of Maj. Gen. Oscar Westover, Chief of the Air Corps, Senator Warren Austin, and Representative Jack Nichols.

• FLORIDA — The MIAMI City Commission has purchased more than 700 acres adjacent to the present municipal airport, and is planning addition of another 300 acres. . . . July 6 the WPA stopped work on an improvement project at Peter O. Knight Airport, TAMPA, on grounds that a lease to Pan American Airways would make the field a private enterprise. Pan American agreed to cancel the lease on resolution of the board of aldermen. Such a resolution was passed, and resumption of work now depends on the board's passing an amendment specifically stating that the field will be operated as a public utility, not under the con-

THE NEW TAYLORCRAFT

will be distributed in central and southern New Jersey by Standard Flying Service, Inc., at Somerset Hills Airport, Basking Ridge. George A. Viehmann is president, Wally Schanz assistant manager.

SMOOTH LANDINGS
are assured at Boise Idaho, Municipal Airport after this Caterpillar Diesel gets in its work

trol of any private group. The Miami City Commission has set Dec. 10-11-12 as the dates of the Miami All-American Air Maneuvers.

• GEORGIA—The airport at Winder, which is rapidly nearing completion, will have two runways, one 3,000 ft. long and the other 2,000 ft. long. A hangar is also under construction. WPA expects to finish its $175,840 airport improvement project at Savannah by December. The hangar will be 180x120 ft. Runways will be 125 ft. wide and 3,000 ft. long.

• IDAHO—The Weather Bureau will establish weather reporting stations at Grangeville and Bonners Ferry. Miss Ida Vincent will be in charge of the Grangeville station, and the Bonners Ferry station will be under the direction of Dewey Akers and Mrs. Minna F. Akers.

A site northwest of Lewiston has been surveyed by the government for possible use as an airport. The WPA has allocated $49,000 for its improvement if the land becomes eligible for government assistance through purchase by a public body—either the city or the county.

• ILLINOIS—A pilots' efficiency flight contest was scheduled for Aug. 15 in conjunction with the Illinois State Fair, under the sponsorship of the Illinois Aeronautics Commission. The WPA will spend $400,000 rebuilding Joliet Municipal Airport. Northwest-southeast and northeast-southwest runways will be constructed, and the field will be graded, drained, and lighted. Frank Fleck and Stanley Kluzek, operators of the Springfield Airport, are planning an air show to mark the public opening of the field.

• INDIANA—The South Bend Pilots' Club, of which Harry S. Wagner is president, has announced that an air show will be held at Bendix Municipal Airport in September. The arrangements committee includes Carl Folsom, chairman, and Arthur Stanley, Homer S. Stockert, Raymond Van DeVeire and Lewis Taylor. The field is being equipped with red and green lights for traffic control. Captain Clarence Cornish, manager of Paul Baer Municipal Airport, Fort Wayne, is seeking WPA assistance for the installation of floodlights and a lighted wind tee at the field. The WPA has already installed boundary lights.

• IOWA—Ottumwa is considering the purchase, for $15,000, of the 124 acre airport which it now rents.

• MAINE — WPA improvements scheduled at Presque Isle airport include a gravel-filled runway, 100 ft. wide and 2,500 ft. long. It will be filled with gravel to a depth of 8 in. The Board of Aldermen of Lewiston has rescinded an order appropriating $8,000 to continue improvement work at the Lewiston-Auburn Airport. Caldwell Sweet, Jr., is president of a new corporation, Main Lakes Air Service, Lucerne.

• MARYLAND — Baltimore is awaiting a PWA check for $1,900,000 before advertising for bids for improvement work at the municipal airport.

• MASSACHUSETTS — Ralph Eames, of Swampscott, is taking the place of Alfred R. Leckscheid as chief instructor for Shobe Airlines, Boston Municipal Airport. Leckscheid resigned to take a private piloting job. Gardner City Council is considering purchase of Gardner airport for $3,500. The field consists of 140 acres of which 38 are used as landing area and for hangar space. East Coast Airways has completed its fourth year at Clark Airport, West Hanover.

Reading is considering action to establish an airport near Lake Quannapowitt. It is proposed as a WPA project. . The $89,200 WPA improvement project at Barnes Airport, Westfield, was started late in July. It will be known as Barnes Memorial Airport and will include 300 acres from the Vincent E. Barnes Estate.

• MICHIGAN—By late July, 70 men were working on the WPA improvement project at Pontiac Municipal Airport. WPA improvement plans at Kingsford Airport call for construction of a 60x40 ft. hangar. $33,000 has been allotted by the WPA for construction of runways at Kellogg Airport, Battle Creek. . Wayne County will spend $50,000 to enlarge the hangar and erect a new office building at Wayne County Airport.

• MINNESOTA — The Hibbing Aviation Club and the Junior Chamber of Commerce were planning their fifth annual air show at the Municipal Airport early in August.

• MISSISSIPPI—Jackson is seeking a $300,000 WPA fund to pave runways, construct a new hangar and enlarge the administration building at the Municipal Airport. A previous $30,000 project is nearing completion.

• MISSOURI — Springfield city officials are discussing a possible WPA project for enlarging and improving the Municipal Airport.

• NEBRASKA — The Providence Engineering & Manufacturing Co has been incorporated at TEKAMAH The company will build aircraft motors. Incorporators Harry Williams, Floyd Tobin, Warren George, George Nelson, and Thomas J Sheehan, Jr. . . A new Stinson Junior has been purchased jointly by A. L. Cooper of SCOTTSBLUFF, Stanley Faulkner of MITCHELL, and Everett Hogan, manager of the Scottsbluff Airport . . . Work has been resumed on the GRAND ISLAND Airport following a brief suspension of WPA funds

• NEVADA—WASHOE COUNTY has set aside $18,000 for the purchase of land needed to enlarge Hubbard Field, RENO. United Airlines has offered to pay the difference between that amount and whatever may be paid for the land The WPA will spend $150,000 to $200,000 for improvements

• NEW HAMPSHIRE — White Mountain Airport, NORTH CONWAY, is the northern terminus for a series of week-end passenger schedules from New York which will continue through the summer Flying equipment is a 10-passenger tri-motor Stinson . . Tom Clow of the Belknap Aero Club, LACONIA, has purchased a Taylor Club

• NEW JERSEY—George A. Viehmann, president of Standard Flying Service, Inc., Somerset Hills Airport, BASKING RIDGE, has announced that his company will be representatives in central and southern New Jersey for the new Taylorcraft. Waldron F. Schanz is assistant manager at the field . . Bernard L. Wiggin has been appointed assistant meteorologist at the NEWARK Airport Weather Station He was formerly in charge of the ALBANY Airport Weather Bureau.

• NEW MEXICO — ALBUQUERQUE has applied to the WPA for approval of a $705,000 project for the construction of a new airport, southeast of the city The city's share of the cost would be $184,000

• NEW YORK—Louis Hagzseld has leased the PLATTSBURGH Airport for a year He will conduct a charter and sight-seeing service and give flying instruction . . To mark completion of extensive improvements at SYRACUSE Airport, the Exchange Club and the Syracuse Aeronautic Association will sponsor an air show at the field Sept 19-20. . . . With twelve to fourteen privately owned planes regularly based at TROY Airport, a second hangar may soon be necessary according to Robert Aldrich, manager of the field . . PELHAM MANOR is considering construction of a seaplane base on Long Island Sound It is estimated that it would cost about $60,000, of which 75 per cent would be borne by the WPA . . . Arthur A. Lane has been promoted to Junior Meteorologist in charge of the ALBANY Airport weather station, succeeding Bernard L. Wiggin, who was transferred to Newark . . . ENDICOTT and BINGHAMTON are negotiating for the joint purchase of Endicott Municipal Airport at a cost not to exceed $15,000 The field contains 200 acres . . . The ELMIRA City Council has abandoned plans for the purchase of the American Airlines Airport at BIG FLATS

• NORTH CAROLINA — It is expected that lighting equipment installation at CHARLOTTE Airport will be completed by early September. One runway was scheduled for completion by Aug. 10 . . . Dr F. M Boldridge, of CHARLOTTE, has been elected president of the Carolina Aero Club . . . HICKORY has taken option on about 112 acres for development of an airport.

• OHIO—AKRON staged an aviation day late in July, featuring Maj. Al Williams, Clarence Chamberlin, and Lieut. Joseph C. Mackey . . . Transcontinental Airport Company, TOLEDO, has rejected the city's proposal to purchase the field for $60,000, the amount of the claims against it The company has suggested that an appraisal be made by a board of three, one to be appointed by it, one by the city, and the third by these two If the purchase is made the city will seek WPA funds for the field's improvement.

• OKLAHOMA — SHAWNEE is planning extensive improvements to the airport, including erection of an administration building, the addition of 80 acres of land south of the field, and lengthening the north-south runway and grading . . Charles W. Short, Jr., manager of TULSA Municipal Airport, has reported a $1,339 profit for the year ending June 30 The field has returned a profit every year since 1930

• OREGON—Dredging has started on PORTLAND's new mile-square airport Three million yards of sand will be needed

• PENNSYLVANIA — Warren B. Skelton and Frank Bowers, operators of GREENVILLE Airport, are planning to move to the Five Points field on the State line . . The Cub Flyers, a group of employees of the Taylor Aircraft Co., were planning an air show Aug. 8-9 at Harri Emery Airport, BRADFORD . . Sherman Lutz, operator of STATE COLLEGE Air Depot, has purchased a new 4-passenger cabin Waco, which will be used for charter flights . . A $78,000 WPA project for SUNBURY Airport calls for enlarging the hangar, lengthening the runways, and grading. Cost to the city is about $3,000

• SOUTH CAROLINA — Beverly E Howard, formerly manager of CHARLESTON Municipal Airport, has accepted a position as co-pilot with Eastern Air Lines He has been replaced at Charleston by William N Craig, who is in charge of Hawthorne Flying Service. Craig will be assisted by Charles L. Howard and Charles Robertson.

• SOUTH DAKOTA—A $15,000 WPA project for erection of an administration building at the W. W Howes Airport, HURON, was scheduled to get under way early in August.

• TENNESSEE—Grading work at McKellar Field, JOHNSON CITY, is 85 per cent complete. The concrete foundation for the administration building has been poured and construction of the hangar is well along The administration building will be two stories high and will have offices, ticket room, restaurant, waiting room and a radio room New 150-ft concrete runways will be laid, one 4,800 ft long and the other 2,700 ft long The field will serve KINGSPORT and BRISTOL as well as Johnson City

• TEXAS—SAN ANTONIO is planning dedication ceremonies for Stinson Airport, formerly known as Winburn Field, Sept. 26-27 . . . DALLAS is seeking a WPA project to extend runways and install lights at Love Field. . . . FORT WORTH has asked for bids on $29,000 in warrants to defray the costs of a new lighting system for the Municipal Airport

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

• UTAH—A commission to recommend suitable legislation governing aviation in the State has been named with E. A. Culbertson as chairman. Other members are Ora Bundy, Porter Robbins, Calvin W. Rawlings, and M. R. Hovey.

• VERMONT—L. E. Marden has been appointed as manager of the RUTLAND Airport by Mayor Henry H. Branchaud.

• VIRGINIA—After a six months' lapse, work has been resumed on the PETERSBURG Airport. It is a WPA project. . . . The State Corporation Commission has granted a license to STAUNTON to operate Staunton Municipal Airport. The city will now seek to lease the field for actual operation. . . . The HOPEWELL City Council has passed a resolution endorsing the joint airport to be situated at CAMP LEE to serve both PETERSBURG and Hopewell. The new field, having four runways, would be situated on property now owned by the Department of the Interior, if it could be acquired. . . . Boundary lights are being installed at Loving Field, the PULASKI Municipal Airport. Thirty-eight lights will be installed. Plans also call for installation of a code beacon.

• WASHINGTON—Eleven planes are regularly based at the county airport at YAKIMA. . . . Wallace Air Service, SPOKANE, has purchased a Stinson Detroiter which will be used for photographic work. It will be piloted by Lieut. Jack Rose. . . . Fourteen WPA workers are grading and leveling KELSO Airport runways. . . . SNOHOMISH COUNTY Commissioners have voted to buy 160 acres of land for an airport. Issuance of $12,200 in bonds was also authorized to cover the purchase price and cost of supervision. Actual work will come under a $240,000 WPA project. . . . The fourth annual air show of the SEATTLE Chamber of Commerce was scheduled at Boeing Field, Aug. 30.

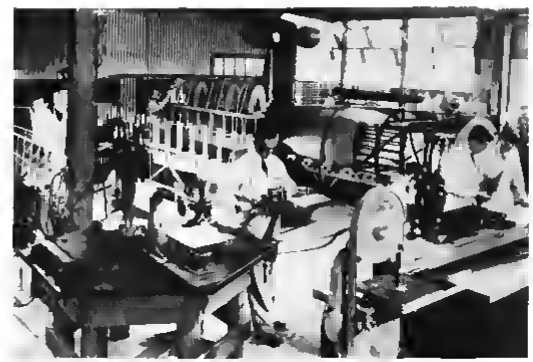
• WEST VIRGINIA—The Bureau of Air Commerce has approved plans for a WPA expenditure of $85,000 on the Huntington-Irontown Chesapeake field. Plans call for draining, grading and filling and construction of two concrete runways, 3,500 ft. and 2,100 ft. long. A 60x100 ft. hangar will be constructed at Scott Field, YORKVILLE. The old hangar was destroyed in the spring floods.

Schools

• Claude Ryan, president of the RYAN SCHOOL OF AERONAUTICS, Lindbergh Field, San Diego (Cal.) has appointed Walter Balch to the position of chief ground school instructor. Virgil McKinley has been appointed assistant airplane shop instructor.

• The Dawn Patrol of the SPARTAN SCHOOL OF AERONAUTICS, Tulsa (Okla.) recently completed its largest mass cross-country flight of the year. Thirty-six students and instructors visited Love Field and the Texas Centennial at Dallas, flying in twelve airplanes ranging from 2 to 8-place. These trips are regular feature of the cross-country and formation training at the school.

• Wendell L. Russell has been appointed instructor in the Aircraft Mechanics Department of the PUTNAM STATE TRADE SCHOOL, Putnam, (Conn.). . . . A flying school for colored people has been opened at the Harlem airport, Oak Lawn (Ill.) by COL. J. C. ROBINSON, who is giving ground instruction to fifteen students. Flying instruction is under the direction of FRED SCHUMACHER, airport manager. . . . A Taylor Cub has been added to the fleet of the FITCHBURG-LEOMINSTER airport, Fitchburg (Mass.). . . . COOK AERONAUTICAL SERVICE, Bowman Field, Louisville (Ky.) is offering a course in aeronautical training, featuring work on structures. . . . HOWARD ALSOP, chief pilot of Springfield (Mass.) airport reports fifteen active students. . . . The ST. JOSEPH AERO CLUB, St. Joseph (Mo.) has been formed by Paul Howell, Jr. Flying instruction will be given at Rosecrans Field. . . . The FLYING CLUBS OF AMERICA, Hanover (N. J.) has been superseded by the U. S. NATIONAL CIVILIAN FLYERS, INC. The new managers are Joseph Weisinger and Charles Roth. Flying instruction is under the direction of Lieut. Van Rawlings. . . . Under the direction of JACK WRIGHT, fifteen students in a WPA ground school at Utica (N. Y.) have recently torn down and completely rebuilt a Warner-powered Monocoupe. . . . The VAUGHAN FLYING SCHOOL, Gloversville (N. Y.) has recently purchased a new Taylor Cub. . . . The GENEVA AERIAL SERVICE CORP., Geneva (N. Y.) will establish a private airport on the old Finger Lakes Airport, and will conduct a ground and flying school. . . . In addition to the Taylor Cub and the Rearwin, JOE CANNON and WILSON MILLS have recently purchased an Aeronca training plane for use at Charlotte Airport, Charlotte (N. C.). . . . The HICKORY FLYING SERVICE, INC. has been formed at Hickory (N. C.) to conduct a flying school on Winkler's Field. Ralph W. Hutton is president. . . . The TACOMA FLYING SERVICE, Mueller-Harkins Airport, Tacoma (Wash.) has purchased a Taylor Cub. Operators of Tacoma Flying Service are Harry Mitchell and Johnny Jones.



HERE BOEING SCHOOL
turns out specialized sheet metal workers to meet the growing demands of West Coast factories.

Aviation People

Who's who and what they are doing

• A few days after the twenty-seventh anniversary of his epoch making flight across the English Channel, Louis Blériot died at his home in Paris (Aug 2) He was 64 years old. M. Blériot had been suffering from a heart ailment for some time Even on his last visit to the United States during the F A I. Congress in 1934, he was under strict orders from his physicians to refrain from any strenuous activity

M Blériot's career in aviation began before the turn of the century. In 1900 he built an ornithopter which was unsuccessful Eight years later he built a machine that would stay in the air long enough to break the existing endurance record of less than an hour Immediately following his 38-minute Channel flight (July 25, 1909) M. Blériot made a new series of distance records but his piloting career was abruptly curtailed by a serious crash and he turned to manufacturing shortly before the outbreak of the war During the war period his plant produced approximately 10 000 planes for the French army and his products were much in demand In the past decade his business had gradually dwindled to the point where he was forced to close his plant in November, 1935 It was to the prospect of finding an American market or licensee for some of his recent designs that he devoted special effort during his visit here. M Blériot was always keenly interested in transoceanic airline development He belonged to the school of thought that visualizes the solution of ocean flying by means of seadromes or some form of artificial stopping places in midocean Many of his designs, however, were capable of long range operation, and shortly before his factory was closed one of his ships broke the world's long distance record

Louis Blériot

Charles Ward Hall

George W DeBell

Tex Rankin

• Aviation circles were deeply shocked on the morning of Aug 22, to read of the death the day before of Charles Ward Hall, owner of Hall-Aluminum Aircraft, Inc, of Bristol, Pa Mr, Hall was enroute from New Jersey to Washington, D. C. in a metal monoplane of his own design, which less than an hour later crashed into a tree near Hopewell, N J A pioneer in the development of aluminum alloy construction for aircraft, Mr Hall had been engaged in airplane manufacturing for a number of years Before moving his plant to Bristol it was located at Buffalo, N Y Most of his manufacturing was done under contract with the Navy Most recent product of the Hall plant was the XP2H-1, largest flying boat ever produced for the Navy Primarily interested in structural engineering, he had developed, together with Archibald M Hall, a unique type of construction noteworthy because of its wide use of sheet metal stock and drawn section members and its excellent rivet accessibility in production As an engineer he was tireless in devising means of lightening his structures by ingenious distribution of metal and balancing of secondary stresses against each other

• George W DeBell has been named chief engineer of Fairchild Aircraft Corp, subsidiary of Fairchild Aviation Corp. Mr DeBell was formerly with American Airplane & Engine Corp and General Aviation Corp, later joining the American Car & Foundry Co where as aeronautical and development engineer, he conducted research and wind tunnel tests on the aerodynamic characteristics of railroad passenger trains and train streamlining problems

• The month brought several additions to the industry's sales ranks Versatile Tex Rankin, who saw service in France, became successively barnstormer, instructor, racer, stunt flyer, and author of a series of text books is now affiliated with the sales force of Aircraft Industries, Southwestern distributors for Stinson Aircraft, Inc W. S Burton formerly assistant traffic manager for Northwest Airlines, Inc at Spokane was made sales manager for the company's Western Montana territory . . . Charles W Smith took on the sales managership of Air Express International Agency

• Fast on the heels of Aviation's 20th birthday, comes the celebration of the 25th anniversary of Richard H Depew, Jr. and Beckwith Havens as airplane pilots Distributors of Fairchild planes, with offices at Roosevelt Field, N Y, the partners made first flights within a few months of each other, in 1911. Depew learned to fly under Maurice Farman in France, Havens under Glenn Curtiss at Hammondsport, N Y. Both were in service during the War, have earned flying honors, and have been actively engaged in the industry for the past decade

• From Trinity College at Hartford to the University of Alabama goes Otto H. Lunde, as professor of aeronautical engineering. Prior to his five years' service at the New England institution, Professor Lunde was connected with the Chance Vought and Fairchild companies, and for three years was a member of the faculty of the Guggenheim School He is a lieutenant in the Naval Air Service Reserves

▪ In the opinion of Eastern Air Lines, the time has come when operations problems must be approached from the feminine point of view To more thoroughly acquaint the distaff side with air travel the air line has established a Women's Department under the direction of Marie C. Sullivan In addition to addressing women's clubs and organizations throughout the country, Miss Sullivan will conduct a

survey to determine possible changes which will make air travel more attractive to women.

● Three new names appear on the roster of Nicholas-Beazley Airplane Co., Inc.—KENNETH E. FRENCH, for five years with the purchasing department at Stinson, as traveling representative in the sales department, also in the sales department is W. C. WHITEHEAD, serving states East of the Mississippi, particularly in and around Cleveland. Newest addition to the purchasing department is C. E. REID, for several years purchasing agent for Sikorsky Aircraft.

● On the passenger list of the Hindenburg's Aug. 9 flight were DR. KARL O. LANGE of the Harvard Blue Hill Observatory, MAJ. E. E. ALDRIN in charge of the aviation department of Standard Oil Co. of New Jersey, and GEORGE S. HUNT of the Douglas Aircraft Co. The latter plans to make a first-hand study of airplane interiors.

● GLENN D. ANGLE has become associated with Grow-Joy & Company of Detroit, consulting aeronautical engineers.

● Continuing its air marking program, the Bureau of Air Commerce has added BLANCHE NOYES to its Washington staff. Mrs. Noyes was among the first ten women pilots to receive a transport pilot's license. She joins HELEN RICHEY, LOUISE THADEN and HELEN MACCLOSKEY in assisting cities and towns in marking roof tops to guide airmen.

● Pan American Airways has selected A. B. HAYES to make an inspection trip over all its systems in both North and South America. Mr. Hayes was formerly the Juneau representative of Alaska Southern Airways and upon the purchase of that company by Pan American remained as representative for the new owner. He was later transferred to Seattle, with now make his headquarters in New York City.

● After thirty years of automobile designing, D. E. Anderson joins Arrow Aircraft Corporation as consulting engineer. Mr. Anderson originated the V-8 type motor for Cadillac in 1912, later perfected the Ford V-8 for racing purposes. His most recent connection was as chief engineer with Bohn Aluminum & Brass Corporation.

● SGT. JOHN H. KENDALL of the Station Complement, Scott Field, was retired from the Army on completion of 30 years' service, thirteen of which were with the Air Corps. Sergeant Kendall has witnessed a decided change in the art of warfare since his service in the Spanish-American War.

Side Slips

By Robert R. Osborn

WE'RE certainly having a tough time deciding where to dig in to hibernate for the next war. At first we thought the cavalry might be a nice outfit to enlist in, but then they abandoned horses, became mechanized, and the General Staff started trying out schemes for dropping the men and their equipment behind the enemy lines by parachute. Then the Forest Ranger service had its appeal for a time until some inventor developed a method of dropping rangers

right at the scene of a forest fire by means of supposedly quick-opening parachutes. Finally we decided that a nice South Sea Island would be ideal, provided that the place had its proper quota of dusky beauties, palm-shaded beaches, missionaries and babbling brooks and had no strategic military value to any nation. That last requirement now promises to be the fly in the ointment of that idea. Every day there are new reports of increasing fortifications in the Philippines, East Indies and the New Hebrides and now comes the newspaper report that France is building a fuel supply base and a flying field on Tahiti.

Wonder if there's an opening for another trapper up in the Hudson Bay district?

WITH the National Air Races being held at Mines Field now the Los Angeles Municipal Airport, this year the industry has a good chance to check how far it has come along the road to recovering its former prestige. We were out there for three weeks during the 1928 show, and at that time you will remember that nothing was too good for aviators. Even though all of the hotels were crowded, the Ambassador, where we were staying, reserved unoccupied for ten days the $30 per day room and $30 per day parlor next to us awaiting the arrival of a certain famous aviator without charging him anything. If any pilot is able to accomplish this same feat again this year we should like to be informed of it, so that we can advise the F.A.I. to homologate the record.

OLD FORT TYLER TO BE TARGET OF ARMY BOMBERS.—Mitchell Field, L. I., July 21.—Fort Tyler, an abandoned brick and stone structure erected in the days of the Spanish American War, on Gardiners Point, a small sand island 2 miles off Gardiner's Island, which lies between the flukes at the eastern tip of Long Island, will be used as a target for Army flyers in bombing practice starting Monday.

Lieutenant George P. Moody, operations officer of the bombardment group said the dummy bombs would be loaded into Martin monoplane bombers, which would be routed from this field to the eastern end of Long Island over virtually uninhabited areas.

"It has been no secret in political circles for some time that some of the Democrats are anxious to shelve Lieutenant Governor M. William Bray. Yesterday's reports said that possibly another had been added to the list displeasing to the New Dealers.

"Gardiner's Point not only attracts bird lovers, but is a popular picnic spot and is in the direct line of heavy summer traffic between Three Mile Harbor and New London."—*News item from the New York Herald Tribune.*

Whispered aside to Lieutenant Governor M. William Bray.—Better not accept any invitations to picnics or bird hunting parties in the Gardiner's Point neighborhood.

THE NEWSPAPERS are making quite a mystery out of the recent bombing plane maneuvers of the Reserve Officers during their annual tours of duty. One paper states, "In the nose of each plane is a secret mechanism about which no questions are answered. As soon as each

plane comes down, the secret box is taken out and put for safe keeping in a safe."

To save other countries the expense of investigating this little box, we can explain what it is. The little mysterious box contains the personal cigars and cigarettes of the officer doing the flying. Reserve officers are always "broke" and in the past many an officer has returned from a practice flight to find his entire supply of tobacco smoked up.

Be Up-To-Date—Read AVIATION Regularly!

FOUNDED when American aviation was in its infancy, Aviation today still leads the way with the latest and most authentic news of the industry. Here you will find new activities and recent developments fully reported and interpreted—usually long before such news appears elsewhere. If you are interested in sport or commercial flying, airport or transport operation, design or production, maintenance work, army and navy progress or, in fact, any phase of the aeronautical industry you will find just the information you want in the pages of Aviation. For brass-tack data—ideas and suggestions which will help you in your every day problems you will find the regular features and departments such as: The Maintenance Notebook, Operators' Corner, News of the Month, Schools, Services and Airports, Flying Equipment, Buyers' Log Book and timely editorials extremely valuable.

Time Saving, Labor Saving, Money Saving

It matters not what branch of the industry you are most interested in, you can save time, labor or money by using the practical information contained in each issue of Aviation. Edited by a staff of experts in their respective fields, Aviation gives you exactly the information you need on every angle of aeronautics. Clear, concise, articles generously illustrated, charts and diagrams —Aviation is edited solely in your interest and is indispensable to your progress in aeronautics.

Subscribe Today to AVIATION—No Money Needed Now

Start at once to benefit from reading AVIATION regularly. Your name and address on the convenient coupon below will bring you this valuable magazine every month. No money necessary now. Just fill out and mail the attached coupon. You may pay in 30 days. But don't put off mailing the coupon. Don't risk missing any of the valuable material now appearing in AVIATION. Mail the coupon immediately—NOW.

AVIATION

330 West 42nd Street New York, N. Y.

Mail At Once

AVIATION, 330 W. 42nd St., New York, N. Y.

Send me AVIATION for one year (12 issues).
I will remit on receipt of your bill.

Name

Address

City and State

Company and Position

SUBSCRIPTION • RATES •

United States, Canada Mexico, Central and South America: $3 a year all other countries $4 a year or 24 shillings

Av F

Classified Advertising

10 CENTS A WORD — $1 MINIMUM

Planes, Engines & Parts For Sale

Indexed—See center column page 78

BELLANCA SKYROCKET In A 1 condition. Equipped with wheel pants and radio. A good buy. Western Light & Telephone Company Huron Bldg., Kansas City Kansas. No 1

STINSON Lycoming SM8A 125 hrs. since good major $1,200, licensed. Link Aeronautical Corp. Binghamton, N Y. No. 2

LYCOMING ENGINES and parts for sale, new and used, also Stinson Model "T" plane and parts. Clarence M Belinn National Airways, Inc., Boston Municipal Airport Boston Mass. No. 3

ENGINES AND PARTS for sale, Liberty 400 hp., Hispano E 180 hp., also quantities of Pratt & Whitney, Wright, Curtiss and Packard engines. The Vimalert Company, Ltd. 841 Garfield Ave., Jersey City, N J. No. 4

$350.00 BUYS Curtiss-Wright Junior just relicensed 105 hours since major and recovering. Stinson SM8A Lycoming airwheels, rate of climb, bank and turn, refinished glossy yellow, black trim. Kitty-Hawk Kinner 100 hp. just majored, yellow fuselage and wings, blue trim. Scintilla dual ignition switches at $1.75, Lunkenheimer primers at $1.50. Large variety of reconditioned BG plugs, Landing gear parts and accessories. Aviation Service Co., Inc., Hartford Conn. No. 5

NEW AIRPLANES $25.00 down, easy payments, 7.00x4 Air Wheels with hubs $15.00 per set. Propellers $2.00 up. Send 25c. for information. Hibbs Fort Worth, Texas. No. 6

WINGS FOR ALL MAKES of aeroplanes for sale. Try our wing exchange, trade your wrecked wings for licensed rebuilt wings. We have been in the wing building business since 1919. N. L. Aircraft Co., Vermilion Ohio. No. 7

TRAVELAIRE 2000, millerized OX 5. Scintilla Mag. Spreadwing job, can be converted to J 5. Recovered and licensed to June 15 1937. $395. Franklin Flying Service, Turner Falls, Mass. No 8

LAMBERT KARI KEEN for sale in good shape. Air wheels. $950. Am leaving country and must sell. PS-348, Aviation 330 W 42nd St., N Y C. No 9

WACO 1935 Custom Cabin, Jacobs 225 hp., wonderful condition. Extras, 70 gallon gas tanks, manifold pressure gauge, landing lights, special paint job blue trimmed in cream very attractive, RCA Radio, and wheel pants. Cost over $7,700, sacrifice $4,950. The R. C. Robbins Company, Cleveland Airport Cleveland. No. 10

WACO CONTINENTAL 165-F2. Never cracked. In new condition throughout, Heywood Wheel Pants, Speed Ring etc. Hottest 485 hours. Always hangared and perfectly cared for. Recovered and refinished, engine majored. Will sacrifice for $1675 worth $2300. As last resort may consider light popular car in trade and finance reasonable balance. You better wire or phone J. Walter Sell, 388 Vine Street, Johnstown, Pa. No 11

WHEELS—New Ebbert-Hatch semi-air complete $70. Available in three sizes. For description and illustration get our Catalog. Snyder Aircraft Company, Municipal Airport, Chicago. No. 12

BEECHCRAFT, 225 Jacobs, 800 hours metal propeller, 70-gallon, radio flares, lights, sensitive altimeter, thermocouple, manifold pressure, parachutes. 285 Jacobs modernized with new cylinders, heads, crankcase, push rod. Beechcraft factory checked 14.2 gallons gas, less than quart oil per hour, ship good as new. Cost over $10,000 price $4,985. Hubert Williams, 1066 Seyburn Ave. (Fitzroy 6377), Detroit, Michigan. No. 13

PITCAIRN AUTOGIRO model PCA 2 Wright Whirlwind R-975 E powered, available for inspection at Boeing Field, Seattle. Has been involved in litigation for a considerable period and held in storage. Offered as a unit or will sell engine and parts separately. Roberts and Skeel 814 Insurance Bldg., Seattle or Claims Department, Continental Casualty Company, Chicago. No 14

STINSON JR. Wright J69 recently overhauled, licensed $1,200. Link Aeronautical Corp., Binghamton, N Y. No. 15

O.X. Waco perfect condition air wheels, Oleo struts, $475. J-5 Phaeton, good condition $850. Aeronca—just licensed $350. Also good selection of other used planes. Aero-Ways Inc. Cleveland Airport, Cleveland Ohio. No. 16

WRIGHT E4 EAGLEROCK ships all recovered and like new. 250 hours on motor since new. Bendix wheels and brakes, tail wheel, Relicensed NC this month. Complete seeding and dusting equipment with metal hopper included. $700 cash. Glenn F Danley, College City, Cal. No. 17

STINSON TRIMOTOR PARTS. Pilgrim parts. Lockheed Orion parts, propellers, magnetos, carburetors, starters, miscellaneous parts. General Aeromotive Corp., Municipal Airport Cleveland Ohio. No 18

TEMP PRESS GUAGES. Wide Safety Belt. Choke with Cable Ignition Switch choice $2. Lambert Valve Pulp Hub Assembly $10. Lambert Fablin Pens $20. Dash Type Throttle $2.60. Trainer Airplanes Inc., Cloquet Minnesota. No. 19

GREAT LAKES—New, 2T-1A serial No. 249 ATC No. 228 Goodyear Wheels Brakes International Orange Rubbed Dope Job. Price $1550. Aircraft Service Inc., Municipal Airport Cleveland Ohio. No 20

WACO A. 210 Continental, night flying equipped, licensed to Sept. 1937. Taylor Cub 1935 70 hours since major, licensed to March 1937. Travelair model 2000 OX 5 with Miller action 30x5 Bendix wheels detachable engine mount, new Supreme propeller. Monocoupe Velie 65 engine just overhauled. Emerwin Jensen Aeromarine 50 engine with 55 hours since major being recovered new. Above planes priced to sell for cash, or will trade or finance. Aviation Associates Inc. Curtiss Airport East St Louis, Ill. No 21

FORD TRI MOTOR J60 810 hrs. total, just relicensed $4,800. Link Aeronautical Corp. Binghamton N Y. No 22

GOVT overhauled 90 h.p. OX-5 $127.50. New 110 h.p. Anzani $99.50. Overhauled 55 h.p. Velie M 5 $168.00. Used 55 h.p. Siemens-Halske $149.50. Overhauled 35 h.p. Anzani $165.00. Used 135 h.p. Caminez $95.00. Bud Ort, 582 Poplar York Pa. No 23

WACO F Warner 125 ship and motor just rebuilt. No time since major. Bargain at $1500.00. J 5 Travelair—ship and motor just majored and rebuilt. No time since major. Bargain at $1250.00. OX Waco 10 ship just rebuilt. For quick sale $500.00. American Eagle tourplane cracked up $400.00 as is with Continental 210 good shape—10 hours since major. Skyways Inc. Cleveland Airport. No. 24

AVRO—AVIAN. Cirrus 85 HP. Licensed June 15 1937. 100 hrs since new motor $545. Consider trading on Aeronca. Beaulard R. Dube Rio Lands, Montague Mass. No. 25

WACO—CABIN—Custom body, 225 Jacobs, only 40 hours total time, perfect condition. Sacrifice $5,000.00. Waco F 3 225 Jacobs many extras like new $4,000.00. STINSON RELIANTS '33 '34 '35 models at bargain prices. Many other planes available. Write E. W. WIGGINS AIRWAYS INC. Providence, R. I. No 26

TAYLOR CUB 1935 A-40-3 Continental motor, just overhauled. Licensed to August 1937. Perfect condition, never damaged. Equipped with winter enclosure, navigation lights, bank indicator and air speed indicator. $650 cash or may be financed. K. Russell Smith, 394 Wyoming Avenue, Wyoming, Pennsylvania. No 27

J-5 RYAN B-1 just relicensed, excellent condition, total time 800 hrs. Price $1,000. Kenneth Garrett, Mgr. Toney Field, Pine Bluff Arkansas. No 28

CURTISS-WRIGHT Air Sedan: Powered with J-6 7-E. Completely overhauled from propeller to tail wheel. Grimes Electric retractable lights, direct electric starter, generator. Wiley flares, radio, price $2,750. Sikorsky S-39. Excellent condition. Grimes Electric retractable lights, parachute flares, radio, price $8,970. Curtiss Challenger Fledglings. Safair Inc. Hangar F, Roosevelt Field, Mineola, New York. No. 29

TRAVELAIR PARTS wings J-5 parts, 2 Stinson SM-8 parts new. Stinson T wheels. Stinson and Stearman tail groups. Scintilla magneto parts. Ford wheels. Prompt and efficient service by experts on rebuilds, overhauls, refinishing and repairs at our Approved Service Station #2. Let us quote you a figure you can't beat for quality and workmanship. Skyways Inc., Cleveland Airport. No. 30

PRIVATEER AMPHIBION. 125 Warner powered, starter, metal propeller and other extras. Recently completely overhauled throughout and in excellent condition for many hours service. K. Russell Smith, 394 Wyoming Avenue, Wyoming, Pennsylvania. No. 31

1935 CONTINENTAL closed Cub $950. 1935 Cub $859. Aeromarine Cub $895. Velie Monocoupe, $595. Taylor Aircraft Company, Bradford, Pennsylvania. No. 32

EPPS BI-PLANE with D. H. Gipsie motor. Plane damaged, motor good. Price, motor $150. Price, motor and plane $210. F. O. B. Athens, Ga. Ben T. Epps, Box 1097, Athens, Ga. No. 33

JS RYAN—Just overhauled — relicensed — A money maker. Meriwether Aircraft, Manchester, Ga. No. 34

LAMBERT MONOCOUPE. Berry Red, new three speed landing gear, ring, steel prop, completely recovered, regular instruments plus airspeed, compass, turn bank, rate climb, navigation lights. 75 hrs since major. Cruising 100 m.p.h. Gas consumption 4.7 gals. hour. Price $1,685. Kenneth G. Sekeriner, 1001 Montvue Rd., Anniston, Ala. No. 35

Page 74—Aeronautical University	36
Page 75—Aircraft Industries, Inc.	37
Page 75—Aircraft Service, Inc.	38
Page 75—Air Transport Eq., Inc.	39
Page 75—Ambrose, Inc., Frank	40
Page 75—Beech Air Sales Co.	41
Page 75—Bennett Propeller Co.	42
Page 96—Boeing School of Aeronautics	43
Page 74—Casey Jones School of Aeronautics	44
Page 75—Chicago Rawhide Mfg. Co.	45
Page 75—Cramer & Co., R. W.	46
Page 74—Grand Central Flying School	47
Page 74—Licon Air Service	48
Page 75—Littelfuse Laboratories	49
Page 75—Menasco Mfg. Co.	50
Page 75—Phenix Aircraft Products Co.	51
Page 75—Robbins Co., The H. C.	52
Page 75—Snyder Aircraft Co.	53
Page 75—Sundorph Aeronautical Corp.	54
Page 75—Titanine Inc.	55
Page 75—Waco Sales of N. Y., Inc.	55A
Page 74—Warren School of Aeronautics	56
Page 75—Wittek Mfg. Co.	57

Products

Flares

WILEY TYPE III, 3-MINUTE FLARES factory reconditioned while they last, $22.50 each. Aviation Associates Inc., Curtiss Airport, East St. Louis, Ill.

Hangars, Portable

PORTABLE HANGARS: Made of wood and metal. The answer to low cost storage, $9.59 monthly pays for it. No down payment. Sebell Air Service, National Distributor, Hightstown, New Jersey.

Parachutes

USED PARACHUTES bought, sold and serviced. Joe Crane, Roosevelt Field, Mineola, Long Island, N. Y.

Services

Patent

PATENTING INVENTIONS is my Specialty—through 28 years as Registered Patent Attorney 7789. Also Trademarks, Investigations, Opinions. Ask me for Special Offer to Mfr. Officials and Engineers. Sterling P. Beck, A-9, 629 F. N. W., Washington, D. C.

Wanted

FAIRCHILD 71 wanted regardless of condition with or without motor. D. A. Carroll, 520 West First Avenue, Spokane, Washington.

WANTED. Will pay cash for good used airplane. What have you? Oscar Scheitel, Harlingen, Texas.

WANTED AUTOGIRO—100-165 H.P. Priced right. Owner must be willing to subject his plane to one week inspection. Write for details. Also 10 Parachutes. Edward DePaula, 952 McLean Ave., Yonkers, N. Y.

Position Wanted

LICENSED MECHANIC. Holds E. License. Graduate of government approved school. Knows all types of modern aviation engines. Can also do airplane overhaul. Now employed as sheet metal man. Wishes employment with reliable aviation concern. Single, will go anywhere. Salary secondary. PW-349, Aviation, 330 West 42nd Street, New York City.

Classified Advertising INDEX

SEPTEMBER, 1936 ISSUE

PLANES, ENGINES AND PARTS FOR SALE

Classification in the classification are numbered at end of last line each ad for indexing

AVIATION SCHOOLS

Planes, Engines and Parts For Sale
PRODUCTS—SERVICES

WHERE TO BUY
NEW EQUIPMENT—ACCESSORIES—MATERIALS—SUPPLIES

Copy for Classified Advertisements in the October Issue Required by September 21st

INDEX TO ADVERTISERS

TYPE Y-1[illegible] — Approximate maximum engine capacity — 145 H. P.

TYPE E-80—Approximate maximum engine capacity 250 H. P.

TYPE F 141—Approximate maximum engine capacity 300 H. P.

TYPE E-160—Approximate maximum engine capacity—700 H. P.

For simplest easiest aircraft engine starting

ECLIPSE

Direct Cranking Electric Starters

ON aircraft where batteries, and battery charging generators of sufficient capacity are carried, Eclipse Direct Cranking Electric Starters are ideal equipment. Continuous high-speed cranking, exceptionally low current consumption, complete protection against backfire and thoroughly reliable automatic engagement and disengagement, may confidently be expected under all normal conditions. Wide range of capacities, for 12 or 24-volt current.

ECLIPSE AVIATION CORPORATION
EAST ORANGE, N. J.
(Subsidiary of Bendix Aviation Corporation)